VOCATIONAL TRAINING IN PLASTICS FOR

PRE-VOCATIONAL CLASSES

by

HILDA MAY HOPKINSON

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Thesis

VOCATIONAL TRAINING IN PLASTICS FOR PREVOCATIONAL CLASSES

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(B.S. in Ed. Massachusetts
School of Art, 1930)

In partial fulfillment of
requirements for the
degree of
Master of Education

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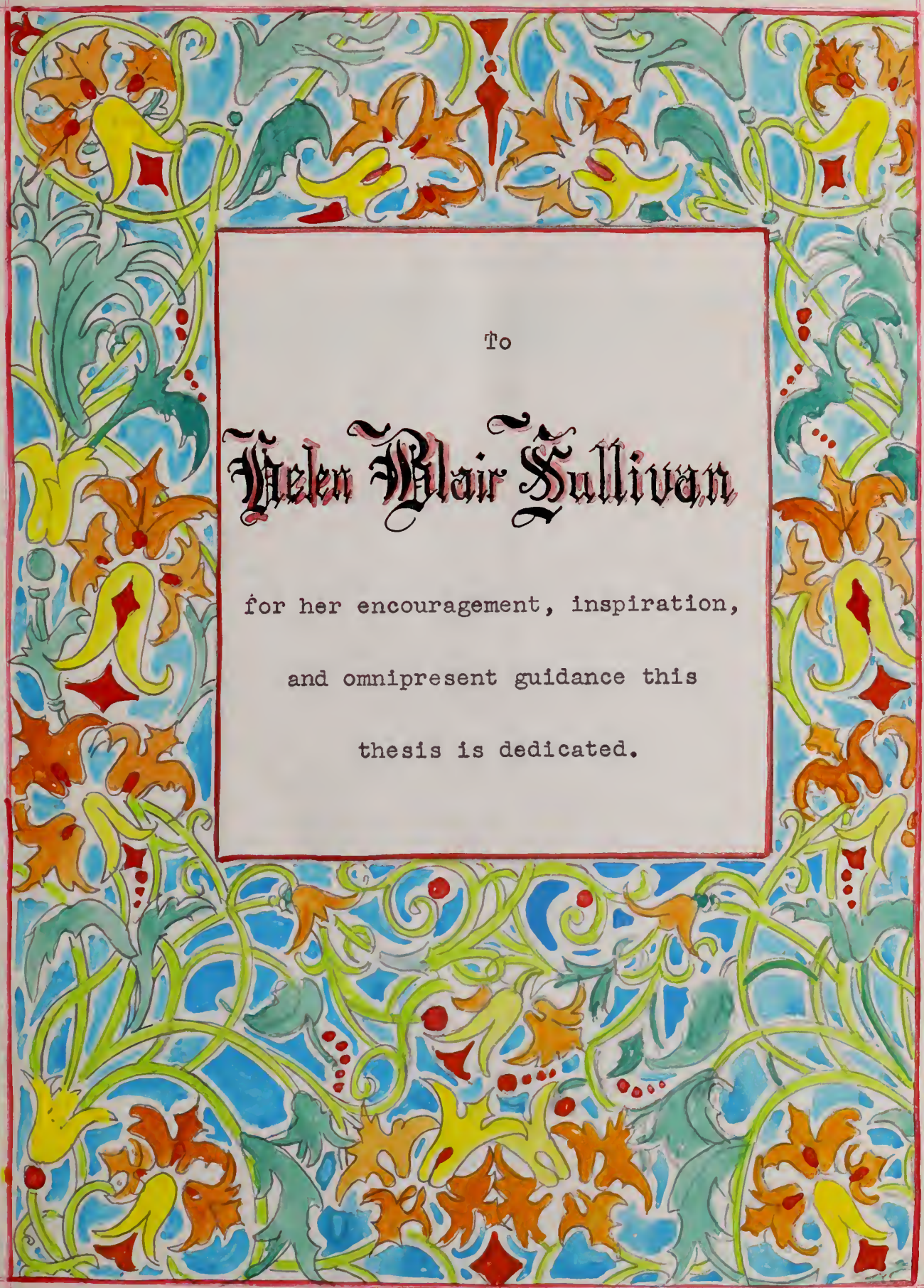


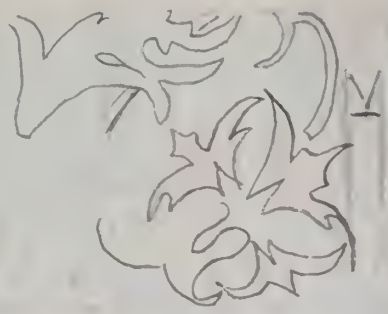
To

Helen Blair Sullivan

for her encouragement, inspiration,

and omnipresent guidance this

thesis is dedicated.



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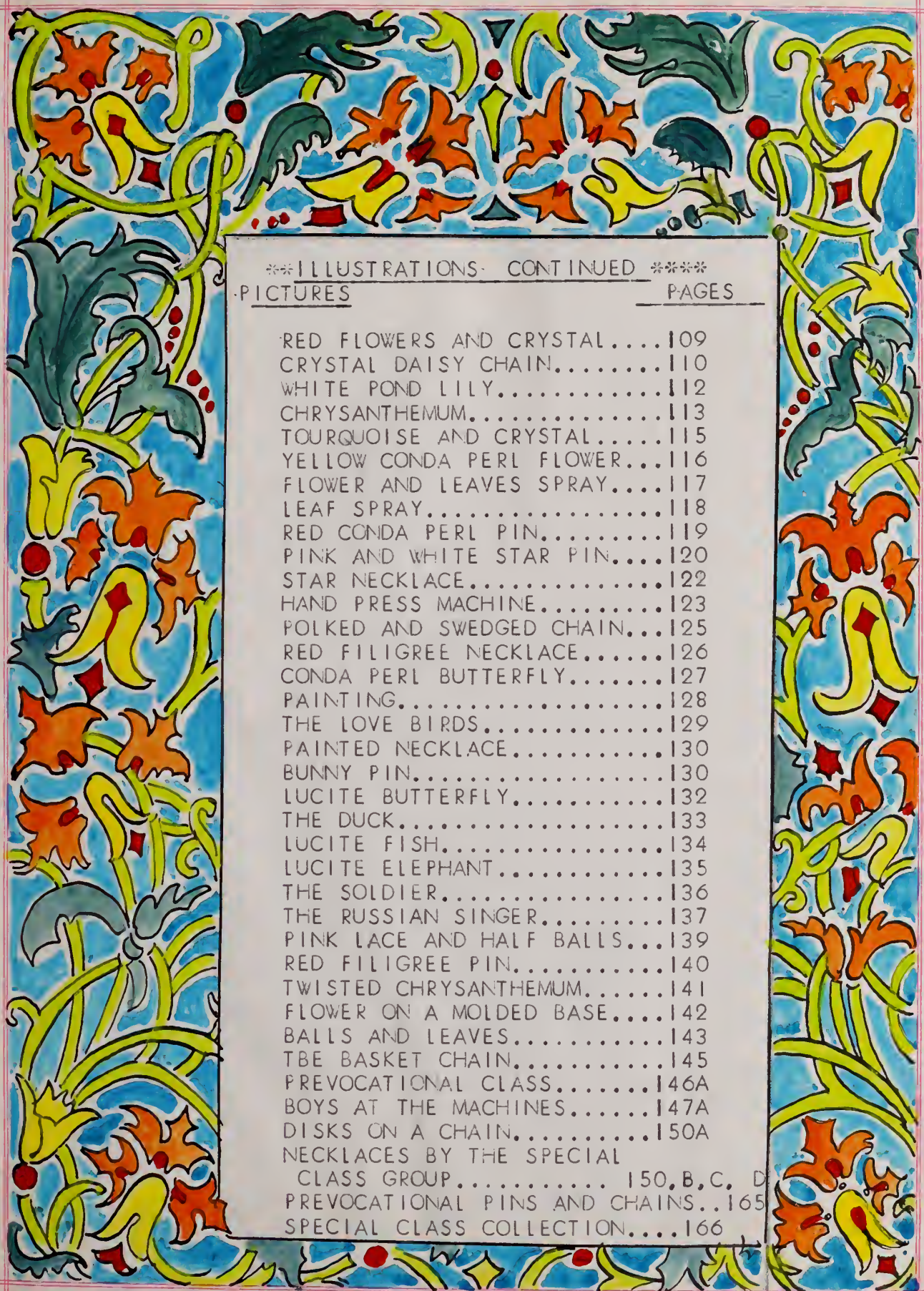

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INTRODUCTION

Martins says,"The occupational adjustment of handicapped adults is a matter that vitally concerns the schools in which handicapped children are taught.It is not a problem that can be ignored until the children become of employable age or until they are ready to go to work. The years which are spent in the classroom must at least furnish the foundation upon which to build a specific occupational training.They must teach him to compensate for his limitations through service well rendered in a field from which his handicap does not exclude him.And in some cases they should furnish the actual vocational preparation which will equip him for wage earning responsibilities. It is hoped that, in the light of these facts, many school systems will find it possible to make further studies of local situations, determine what additional responsibility should and can be accepted.and take steps toward the realization of their ideals for a program of occupational experiences for the handicapped adolescents."[1]

1 Elsie H. Martins, Occupational Experiences For Handicapped Adolescents In Day School. Bulletin XXX.1937.p.1.

CHAPTER I

STATEMENT OF THE PROBLEM

In the light of the foregoing statement the writer feels that the best education the mentally retarded children will acquire will be that acquired in the special classroom. The majority leave school when they are sixteen to obtain work. While in school they should be taught how to adjust and be self-sufficient members of the community.

Since it is known that ninety per cent of these people go into industry, the author felt a survey should be made of the work opportunities in their communities and training given along these lines. As a result these boys and girls could find their places and be self-supporting citizens when they left school.

In industry they are placed under people who do not understand them and expect the same from them as of normal individuals; consequently both parties are dissatisfied. The individual drifts from one job to another until he happens to find work within his mental understanding and ability.

During the author's three years as designer for one of the local plastic companies, she had an opportunity to work with and study many of these people. Because of this work with them she feels that if they were trained by someone who

understands their individual needs they could enter industry knowing what they should do and be well placed in a practical occupation. Such a program should be of benefit to the child's future.

s Baily said, "It is the quality of training that has been given rather than the intellectual level that concerns the employer."[1] The problem of this study simply stated is to ascertain the value of vocational training in the plastic fields for the mentally retarded and to determine whether such training can be successfully taught in a pre-vocational class.

Some of the questions this study will try to answer are:

1. Where do the pupils of the prevocational classes go when they leave school?

2. How many of these children, in a given community, are working in the plastic industry?

3. Have any of them had previous training in plastic work?

4. What equipment would be necessary to set up a workshop in such a classroom?

5. Should the teacher have previous training in plastic work to teach the class successfully?

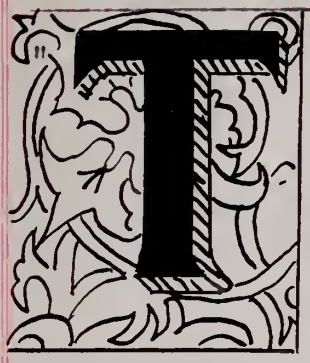
---

1 Pearce Baily. "Mental Deficiency; Its Frequency and Characteristics in the United States as Determined by the Examination of Recruits." Mental Hygiene, IV (July, 1920), p.573.

6. Would such a project have any value to a class in a community where there were no plastic factories?

CHAPTER II

A REVIEW OF PREVIOUS RELATED STUDIES



he term subnormal when applied to intelligence is commonly used to denote those individuals who because of mental inferiority of a stated degree are eligible by law for special class educational placement."[1]

Leta Hollingworth defines a subnormal, "Those who deviate from the norm in the direction of inferiority we call the subnormal children."[2]

She continues, in essence wise adjustment if undertaken in greater measure will prevent a lot of trouble to society at large. Subnormal children develop more slowly than normal children. Their sensory factors are not far less acute than in average people. The difficulty lies in being able to interpret or organize these sensations. Such persons are credulous and gullible.

No one can overcome mentally deficiency; no amount of training will bring intelligence. Education can only direct and control.

She concludes: "Mentally deficient children approach nearer to normals in motor ability than in mental ability. The overlapping is great and many of the mentally retarded

---

1 Miriam Pritchard. The Mechanical Ability of Subnormal Boys. p. 7.

2 Leta Hollingworth. Psychology of Subnormal Children. p.5.

children exceed some normals in motor ability."[3]

his study includes four of the accepted catagories of intelligence: the dull-normal, the dull, border line, and the moron.[4]

Kirk says, "The high-grade mentally defective child is considered educable, and with proper training can become independent of external trades and participate in the world's work, and become partially or totally self-supporting."[5]

He continues, "The borderline defective (I.Q. seventy-eight) is usually trained in the public schools and not in institutions. He may attend classes for the high-grade mentally retarded or remain in the regular grades."[6]

Kurtz writes, "Every child should have opportunity to develop responsibility and learn to participate in the life of the community but this should be done under conditions appropriate to his age and capacity....I feel it is up to the teacher to give him this training so he can take his place in the normal life of the community."[7]

Baily describes a moron as...."one capable of earning a living under favorable circumstances but incapable of competing on equal terms with his normal fellows."[8]

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3 Ibid.,pp. 94-138.
4 Lewis M. Terman. The Measurement of Intelligence. p. 78.
5 Samuel Kirk. Teaching Reading to Slow Children. p. 14.
6 Ibid.,p. 15.
7 Russell Kurtz. Child Welfare. Social Year Book. VII. pp. 106-107.
8 Pearce Baily. po.cit.,p.572.

Baily continues to say, as he discusses the semi-skilled in the factory, "It is the quality of training that has been given rather than the intellectual level that concerns the employer of this variety of labor whether such be an employer or a recruiting officer."[9]

Goddard states, "The moron is the difficult class to recognize, the class that constitutes our social menace because they look like normal children and, to the untrained, often seem normal. They are considered responsible and burdens are laid upon them which they in reality are incapable of carrying."[10]

Oliver says, "The bothersome, the difficult class is made up of those mental deficients whose extreme intellectual development lies between that of a seven and twelve-year-old child. This class we call morons....

"However, we hear in these days a lot about morons and moronic behavior. But we must remember that the morons are the hewers of wood and the drawers of water in this world; they are the people who do the simple routine work and who are incapable of anything more complicated....Moreover, morons are often emotionally unstable....They are unable to adjust themselves to new situations. There are millions of morons working successfully all over the world at routine jobs;....

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9 Pearce Baily, op.cit., p.573.

10 Henry Goddard. School Training of Defective Children, p. xxii.

face him with some unexpected, some difficult situation, and he will be unable to deal with it—or else he will deal with it in a wholly unexpected manner. Give him a regular job, and he will keep faithfully at it. But let him be thrown out of work—let him have to go around hunting work, and he will not find it. He does not know how."[11]

igelow says, "The actual number of mentally retarded children in the population is not known but it is probably greater than the estimated one per cent of about three hundred sixty thousand children under sixteen years of age."[12]

Kirk states, "According to the studies which have been made on frequencies of mentally retardation in schools, two out of every one hundred children in an average American community are mentally retarded and require a modified curriculum for their maximum growth and development."[13]

Frandsen says, "The moron distribution completely overlaps that of the normal population....The mean score of the moron is only 15.85 as compared with the fifty for normals."[14]

Ayers says, "The retarded student becomes discouraged through lack of success. Success is necessary to human beings.

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11 John Rathbone Oliver. Psychiatry and Mental Health, pp. 125-126.

12 Elizabeth Bigelow. "Experiment to Determine the Possibilities of Subnormal Girls in Factory Work." Mental Hygiene, V (1921), p.3.

13 Samuel Kirk. op.cit., p.5.

14 Arden Frandsen. "Mechanical Ability of Morons." Journal of Applied Psychology, XXI (August, 1935), pp. 371-378.

To live in an atmosphere of failure is tragedy to many. It is the teacher's job to eliminate this."[15]

nskeep writes, in essence, that some believe that handwork should be the form of education for morons and imbeciles. This misconception along with the fact that dull normals and morons usually earn a living, when they are self-supporting, by manual labor has fostered a rather widespread feeling that the retarded child has some special talent for handwork. "Not all handwork is a desirable end in itself or in the future life of the child. The more muscular activity and more highly developed and more highly coordinated movements become, the greater the intelligence....A large proportion of school failures would become competent tradesmen if methods of instruction were adapted to the type of mentality which such people possess. This conclusion means much for salvaging human resources."[16]

Bigelow states, "We have often wished that there might be closer cooperation between the school and industry. It is hoped the time will come when education and industry will work more closely together along many lines to their mutual benefit."[17]

Hoopes declares that the regular shopwork in the school

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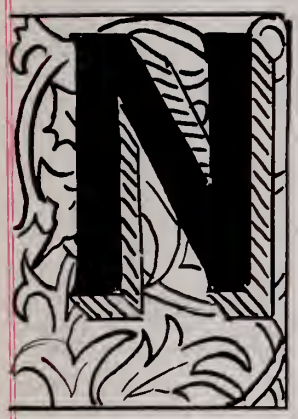
15 Leonard Ayers. Laggards In Our Schools, p.9.
16 Annie Inskeep. Teaching Dull and Retarded Children, pp. 333-383.
17 Elizabeth Bigelow. op.cit.,p.3.

can be adapted to meet the needs ofthe dull children. He advocates the introduction of training that will prepare them to fill jobs within their capacities.[18]

 eterer concludes, in her study of eighty special class pupils that had left school, that,

1. "The majority of special class pupils go into industry.

2. "The special class pupils fill the blind alley jobs—the essential odd jobs that are undesirable to an ambitious individual, but absolutely unavoidable in industry.

3. "They seem unable to take responsibility.

4. "Those who go into industry are on the whole self-supporting in ordinary circumstances particularly if under some sort of supervision.

5. "There is a large per cent of drifters both in regard to residence and in regard to the job held, due largely to personal characteristics."[19]

Neterer continues,

6. "As a class they are unable to cope with new or unforeseen conditions.

a. Only twenty-five per cent save money to any extent.

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18 Paul C. Hoopes. "What to Do with the Dull Child." Industrial Arts and Vocational Education, p. 8.

19 Inez Neterer. "Follow-up Study of Special Class Pupils." Ungraded, Vol. V, Nos. 6,7, (March-April, 1920), p. 154.

b. External conditions in industry affect them largely.

7. "Some become valuable citizens."[20]

ellogg reports, "One of the specific objectives of the Newton's special classes as given by Annis M. Sturgis, head of the Newton special classes, is to provide an education which will meet the capacities, limitations, and interests of each child. This involves finding types of academic and industrial work in which the pupils can get the satisfaction which comes from success, because achievement in this work is within his power. Education which will enable each pupil to be able to be a contented citizen, to be self-respecting because he has been trained to do something well, to have confidence in undertaking new tasks, willing to take directions and to follow a good leader."[21]

Kellogg found in her study a positive correlation with the employment of individuals between the quality of handwork done in the school and their work out in the community. Those who had done poor work in school were unemployed, those who had done well in school were employed."[22]

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20 Inez Neterer. op.cit.,p.154

21 Roberta Kellogg. "A Follow-up Study of One Hundred Males Who Spent Some Time in the Special Class in the Public School of Newton, Massachusetts." Unpublished Master's Thesis of Boston University, 1941, pp. 6-7.

22 Ibid.,p.14.

he says that a significant fact in the promotion of teaching many kinds of handwork is the development of maximum of motor coordination and the training in the greatest possible number of motor coordinating experiences needed to utilize their special abilities.[23]

Of the eighty-seven cases studied, Kellogg found thirty-eight employed full time, seven part time,and forty-two without work. She listed forty-seven different kinds of employment. Nearly all fell under the grouping of manual labor, menial labor, or semi-skilled work. "There is real need, for it is an opportunity to train these youngsters in meeting social situations."[24]

Bigelow, when discussing these individuals,says, "They are very reliable. If sufficient training in some simple task they can be depended upon to perform that task indefinitely....Under right conditions subnormals will become the most reliable of workers, sticking to their jobs indefinitely with no thought of change. Each must be handled as individual cases for their individual differences are much greater than in a normal individual."[25]

The author has found the above statement to be true in her own experiences in the factory. When a sample was to be made one of these men or women was preferred to a normal

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23 Roberta Kellogg. op. cit.,p.14.
24 Ibid.,p.14.
25 Elizabeth Bigelow. op.cit.,p.310.

person for they will follow instructions as given. Many times both time and materials are wasted because a person imposes his idea of how the job should be done.

his would not happen with one of these people. If taught carefully,no one can change them to do it a different way unless the one who gave them the work to do says it is to be done "this way". One of the author's most reliable assistants is a girl who spent three years in a prevocational class. She had an I.Q. of seventy-six; after thyroid treatments her I.Q. has been raised to eighty-two. A more reliable girl could not be found.

Another case a girl with an I.Q. of sixty-five has become so skilled in the painting department that she is now a forelady and a good one.

Channing made a study of eleven hundred seventy-two boys and girls to learn how the mentally retarded adjust themselves in industry. Her group located ten hundred sixty-seven. Ninety-four per cent were employed at some time; sixty-nine per cent, non-employed. It was learned that when the work fitted the individual's needs he stayed. The girls were just as steady workers as the boys. All were employed in the many industries in the seven cities where they lived. The work was semi-skilled and required little education, but study showed that those who had been trained and were good in hand-work were able to hold their work better and to increase their

wages.

Individuals with lower I.Q.s made fewer changes. Forty-seven per cent of the boys with I.Q.s of fifty to sixty, as compared with the per cent of those with I.Q.s of seventy plus, changed positions less than once a year, possibly because the lower mental levels imply the willingness to do irksome and monotonous tasks....The group concluded from the wages and the regularity with which these people worked, "it would appear, that the annual earnings of a large proportion of them enable them to at least support themselves. Seventy per cent earned a minimum of twenty dollars; many earned as high as forty dollars in a week."[26]

Channing says, "Further intensive study of the relation between the personality of mental defectives and their industrial adjustment should be made, and so far as possible a practical scale of measurement for social behavior to supplement intelligence tests should be worked out."[27]

The Massachusetts special class manual says, "No type of special education is challenging more attention at this time than the education of children who are mentally retarded. Through the enactment of a law in 1919 Massachusetts became the pioneer in this type of public education."[28]

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26 Alice Channing. Employment of Mentally deficient Boys and Girls, Bulletin, No. 212, Washington, pp. 1-69.
27 Ibid.,p. 69.
28 Manual for Special Classes. Commonwealth of Massachusetts, Bulletin, No. 2. Whole No. 244, p. 44.

he manual continues, "So rapidly has the movement grown that at the present over six hundred special classes have been organized in connection with public school systems of the state. These classes enroll about ten thousand children who are three or more years mentally retarded." A study was made of two hundred thirty boys and girls, ages sixteen to twenty-one years, who had passed through the special classes. On the result of the study a new curriculum was built to fit the needs of these children. The study group learned just how much could be expected from persons with mental ages as low as five years up to ten years.

They concluded,"Children in classes for the retarded will become, in adult life, members of the community. They should associate in school life and play with normal children to get ready to live with adults as citizens in a community ....must take materials within their range of abilities and understanding to fit them for the business of living. Knowing their mental age capacities the teacher can lead and guide them into their own special classroom work, as outlined in the manual, under a well trained teacher, this can be done."[29]

Averill says, "The teacher's personality exerts a dynamic influence over students for they learn more from example than from books. Therefore the teacher should be

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29 Manual for Special Classes. op.cit.,pp. 44-47

wholesome and inspirational as well as good in scholastic and pedagogic skill....the teacher needs to be a mental hygienist."[30]

Butt, when discussing the teacher for these children, says, "The teacher figures more largely in their lives than in a normal group. Hence it is a privilege to be a personal tutor than a master." The teacher must be practical as distinct from academic, with learnings that are concrete rather than bookish, with a talent for manual work and expression rather than for what is merely literary or scholastic. She should be versatile rather than a specialist; most of all she should possess an interest in people.[31]

Goddard says that an adequately trained teacher is one who is loving and understanding, free from prejudices, familiar with all types of work. She should be vitally interested in her pupils as individuals.[32]

Martins writes, "The characteristics and needs of mentally handicapped children call for a teacher who is sincerely interested in helping them, adapted by personality to cope with the problems presented, acquainted with the educational and psychological factors involved and well prepared in both knowledge of the subject matter and teaching skill. The teacher of occupational work should meet these conditions no less

30 Laurence Averill. The Teacher as a Mental Hygienist. p. 82.
31 Cyril Butt. The Backward Child, p. 564.
32 Henry Goddard. School Training of the Defective Children, p. 9.

than any other."[33]

The author mentions these facts to show how important it is to train these children while in school under the supervision of the classroom teacher who has been chosen because she is the type of person to train these children. Such trained persons will not be found in the ordinary factory where these children will go to earn their living.

Ingram made a study of the education of the slow learning child. She writes, "There is the same need for the understanding of the potential abilities of the dull-normal child, his slow rate of development, and his methods of learning, as there is of understanding the mentally retarded. Such pupils are numerically important; they comprise approximately fifteen to eighteen per cent of the school population. Studies of the behavior problems of truants and of juvenile delinquents also indicate that this group is a serious problem to society. This study reveals that in addition to the number of offenders who are mentally retarded, a still larger number of delinquents come from the borderline and dull-nomral groups and that school failure has been directly related to their maladjustment."[34]

She continues, "Their potentialities will not be along academic lines....individuals who are rated as borderline and dull-normal on the basis of intelligence tests and academic

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33 Elsie H. Martins. op. cit., p. 12.
34 Christine Ingram. Education of the Slow Learning Child, p. 389.

achievement are not necessarily below average in mechanical, art, or other specialized abilities. There is need for recognizing all such aptitudes. To be sure, all slow children will not be found to possess them, but there are undoubtedly more who do than the school at present is geared to discover. Adequate provision to discover and develop such individual abilities is a desirable and necessary phase of the education of the dull-normal."[35] ...."It should be understood that differentiation for these pupils is not essentially a quantitative one; not that these children could do all the work if they had more time, but rather they need a different type of work as well as different methods of instruction....to fit them as far as they can be fitted for the business of living and earning a livelihood."[36] ...."As social and industrial conditions force the school to continue education beyond the generally accepted school age limit, the problem to adequate this group confronts us more immediately than ever before. When the school comes to the full realization that understanding children is of prime importance and that the subject matter is secondary, then, and only then shall we help each child to realize his own potentialities rather than to strugle for impossible attainments set up by a system of education. Under such conditions the borderline and the dull-normal will have an equal chance with others for successful achievement

35 Christine Ingram. op.cit.,pp. 393-404.

36 Ibid., p. 406.

at their own level in school and in life outside of school."[37]

ritchard carried out an experimental study to test some factors apart from intelligence which might be a contributing force in the trade training performances of subnormal boys. It deals with the adolescent age, the group male from one institution of one ethnic stock, Jewish. She says, "There have been conflicting view points on manual or shop training courses offered in the schools....some believe since subnormals could not learn to do anything else, manual training was the one subject wherein they might succeed.... 'Link stated that the subnormals were as inferior in manual ability as in more intellectual work but training in manual skills was essential for them to cope with the industrial world.' ....A considerable amount of responsibility in industry can be placed on both sexes at the eight year mental level."[38]

She continues,"Individuals with mental ages between ten and twelve are capable not only of much routine but also a considerable amount of intelligent responsibility and supervision such as storekeeping."[39]

She says in regard to the morons, "They can be trained to take pains up to a certain point but beyond that point they

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37 Miriam Pritchard. The Mechanical Ability of Subnormal Boys, Contribution to Education, Columbia University, 1937 p.2.
38 Ibid., p.3.
39 Miriam Pritchard. op.cit., p.3.

cannot go. They cannot handle a job that has many parts to keep track of, many steps to learn."[40]

he concludes her study by saying, "The Mechanical Ability tests, it would seem, serve as an instrument in discovering some individual in a group made up entirely of mental inferior subjects, who possess mechanical ability equal or superior to the norm of the population."[41]

...."As the adequate standardization and use of vocational tests become more prevelent and if this finding of uniqueness is verified, individuals who possess little or no mechanical trade ability will be discovered in increasing numbers."[42]

...."The criterion has shown that achievement in this field is not an abstract quality, but one capable of lending itself to fine degrees of measurements. An adequate standardized word scale, similar to the present handwriting scales, might be valuable as an additional measurement of mechanical ability."[43]

Lord made a survey of four hundred forty-nine special class pupils to determine the need for social supervision of children under twenty years of age. Four experts working under Doctor Raymond, superintendent of the Wrenthem State School, and Arthur Lord gave four months of their time to this study. They interviewed two hundred thirty mentally retarded boys

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40 Miriam Pritchard, op.cit., p.3.
41 Ibid., p.64.
42 Ibid., p.65.
43 Ibid., p.67.

and girls who had left school from the special classes and two hundred nineteen children who were still in the special classes. In the group outside of school, 3.9 per cent were found inadequate in vocational adjustment. These fell into the low I.Q.s. These fifty were really institutional cases and should not have been in school. The average I.Q. was seventy. Many had been employed at the same work for many years. The salaries earned ranged from fourteen to twenty-five dollars a week.

n conclusion they said, "The school work indicated the value of handwork as a vehicle for teaching these children." They learned how these children had adjusted themselves and how they spent their leisure time in general. They learned that while 57.3 per cent needed no further guidance in the one hundred ten group, ages ranging from eighteen to twenty, and the one hundred ten school group, ranging from fourteen to sixteen, 29.9 per cent needed no guidance but some needed fairly close supervision in guidance. Many needed only wise and skilled advisors in the community to whom they could go with perfect freedom when they felt the need of help....That training is more important than academic learning. That with emphasis on skilled and perfected teaching in the special class, results will be relatively improved."[44]

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44 Arthur Lord. "A Survey of Four Hundred Forty-nine Special Class Pupil", Journal of Educational Research, (October, 1933), pp. 101-114.

The White House Conference Group on Child Health and Protection made a study of one thousand sixty-seven boys and girls enrolled in special classes in seven cities to ascertain the need of change in the laws and curriculum of these classes, to better fit the needs of the subnormal child. The study covered the after school histories of these boys and girls, mostly classified as morons: some were high grade imbeciles; others, only slightly subnormal. It was learned that most of these former class pupils entered industry. More than nine tenths had been employed after leaving school. The occupations in which these imdividuals found employment were on the whole unskilled and semi-skilled, which require very little academic education. A large number were working in factories, Nearly all were successful in at least one occupation, which indicated that when given work within their understanding and on their level they could handle the work. The girls not in the factories were in domestic service.[45]

Doll reported that eighty per cent of the school day was spent in academic instruction and only twenty per cent on manual and industrial subjects. He says, "The majority of subnormal children earn their living at manual labor. In order to educate subnormal children successfully in the public schools, it is necessary to break away from the traditional

45 White House Conference on Child Health Protection and Special Education, The Handicapped and Gifted Child, pp. 439-456.

study with respect to subject matter and methods of instruction....They need special methods of instruction and longer total periods. They require much instruction in fields which are entirely omitted from standard courses."[46]

e continues, "The subnormal child can be put at productive work earlier than the child who needs more time for preliminary training. He should be prepared for his work as long as possible as he will leave school at sixteen and his education will stop there. He will only get that which he learns while in school."[47]

Berry stresses the importance of physical and manual training and the formation of desirable habits as worth more in importance than the acquisition of academic knowledge. "As the majority of subnormal children will earn their living at manual labor, the formation of desirable habits in the education of the subnormal is just as important as the development of strength and skill because he could not hold a job unless he kept general rules expected from all workers, such as punctuality and regularity."[48]

Martins made a study of the education of exceptional children who were mentally and physically handicapped. In forty-three cities, there were twenty-nine thousand eight hundred eleven pupils enrolled in the special classes for

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46 White House Conference. op.cit., p.457.
47 Ibid., p.457.
48 Ibid., p.457.

retarded children.

he says, "During recent years the problem of the occupational adjustment of mentally handicapped young people has become increasingly acute. In spite of conditions which on the surface appear to be so unfavorable to the occupational adjustment of the mentally handicapped, the day school still carries a definite responsibility for sending out into the workday world young people who have been trained to do something of occupational value and to do it well enough to make them fairly acceptable members of the working society. Doubtless not all children enrolled in special classes can become self-supporting or even partially so....but with most cases of borderline or moron intelligence comprising the majority of special class numbers there are definite even though limited possibilities for wage earnings."[49]

She continues to say, "Of the twenty-nine thousand eight hundred eleven enrolled twenty-five thousand three hundred twenty-three or 84.9 per cent were reported as receiving occupational training of some kind. The median for the group is thirty-five per cent of approximately eight to ten periods a week."[50]

Continuing, "The many studies that have been made in the general field of the curriculum for all children have repeat-

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49 Elsie Martins. op.cit., p.6.
50 Ibid., p.8.

edly emphasized the principles that, in the first place, experiences should be brought into the schoolroom from the world of experiences met in the community outside the school; and that, in the second place, the value of school experiences to the child depends upon the degree to which they help him to make the out-of-school experiences more meaningful and satisfying. Occupational activities for retarded adolescents present to exception to these principles, for such children must learn to fill their niche somewhere in the community life. Consequently the occupational opportunities of the community must determine the types of occupational preparation which the school should offer."[51]

he says, "It is also generally agreed that, from the standpoint of vocational guidance, exploration of and participation in a variety of occupational activities is a wholesome experience for the adolescent, particularly for mentally handicapped pupils, who will in the majority of cases never become skilled artisans: a variety of elementary experiences in a number of directions has been considered preferable to an intensive and prolonged period of training in one specific occupation."[52]

Martins continues, "With proper vocational guidance, selection and training, many of those now roaming the streets

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51 Elsie Martins. op.cit., pp. 9-10.

52 Ibid., p. 10.

as idlers, law evaders, and law breakers could have been saved for life of occupational efficiency. To quote one resident, 'Trained workers in humble occupations are better than occupants of houses of prostitutes and penal institutions.' The time is ripe to do something for society as well."[53]

Detroit, Michigan, had special classes in her school system as early as 1903. Now there are sixty-five classes for the mentally retarded pupils under thirteen years of age. Special class instruction is individual in that the subnormal child has peculiarities of learning. Materials and problems are presented which have a life interest and are within the comprehension of the pupil.[54]

Martin says of the Detroit schools, "In general forty per cent of the school is given to industrial occupation or prevocational training. Approximately two hundred fifty children per year receive this training."[55]

Martin concludes her study by saying, "It has been repeatedly said that little academic or specific industrial training is necessary for the type of jobs which are open to special class boys and girls; that employers prefer to take on a person who has been trained in the habits of industry and desirable conduct, and then proceed to give the necessary

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53 Elsie Martin. op.cit., p. 18.
54 Education of the Mentally Handicapped in the Detroit Public Schools. Bulletin. 1937, p. 59.
55 Elsie Martin. op.cit., p.29.

training for the specific job themselves. This is the basis upon which some schools justify the lack of occupational preparation in their programs. Such a statement, however, applies to the multiplicity of jobs in the manufacturing and mechanical industries more than to the service field....Important as the inculcation of proper habits and attitudes is, if it is accompanied by varied occupational experiences the boy and girl will be so much the better equipped for meeting the practical problems of the wage earner. Fortunately it need not be a question of doing one or the other, rather a matter of including both in the educational program."[56]

Bigelow carried out an experiment to determine the possibilities of subnormal girls in factory work. She wished to ascertain if certain subnormal girls could be trained to do factory work in the rubber industry in a special class. Due to labor shortage, which is the same situation as that of the present time, a large rubber concern was faced with the problem of using these people in the industry or close. They were far sighted enough to realize the permanent placement of these people in the semi-skilled jobs.[57]

Many of these jobs were monotonous, requiring less skill, and if done by these people, the more difficult jobs could be done by the higher intelligent and so solve the industrial problem. "These individuals are perfectly happy and satisfied

56 Elsie Martins. op.cit., p.23.
57 Elizabeth Bigelow. op.cit., p. 302.

with monotonous unskilled jobs. This might decrease labor turn overs and be beneficial to all workers...They were often misfits; they did not get on well with other workers and were difficult to manage; many not suited to their jobs."[58]

n this basis the company decided to carry on a piece of research as far as possible on a strictly scientific basis. They found an experienced person to conduct the experimental class in a separate workroom in the factory set aside for the classroom. Difficulty arose in finding a student body. Finally twenty-three were enrolled. "Individual differences between sub-normals are even greater than among normal workers." They found each one an individual problem. "The moron group, mentally eight to eleven, were capable of developing a moderate degree of skill in industrial work. Usually they do not acquire much speed but two-thirds of the standard production. Occasionally with effort, or if having more manual ability, they develop into excellent workers and are an asset to industry.....

Those with five to seven years mentality are able to perform simple monotonous jobs when trained; they need no supervision and become contented and faithful workers...The sub-normal has certain desirable qualities not often appreciated but well worth considering. They are very reliable and if given sufficient training in some simple task they can be

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58 Elizabeth Bigelow,op.cit.,p.303.

depended upon to perform that task indefinitely."[59]

superintendent of a canning factory in a Chicago stockyard said, pointing to a certain woman, "It took a long time to pound the idea into her head but when this grade of woman absorbs an idea she holds it. She is too stupid to vary. She is as sure as a machine. We need this type of woman for our work."[60]

Bigelow says, "When placed under someone who understands them and who gives them the extra attention and encouragement that they need their personal loyalty is very great. Under the right conditions subnormals will become the most reliable of workers, sticking to their jobs indefinitely, with no attempt to change."[61]

She continues, "Training is the key to the situation. Borderline cases will never get to institutions. Their training should begin in the special classes in the public schools. From there the natural step should be directly into some form of occupation; under the guidance of the after acre worker. Industrial work, without training or supervision, will not produce satisfactory results. If the industry is unwilling to assume the expense of training such a group of workers, it

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59 Elizabeth Bigelow,op.cit.,pp.306-310.

60 Ibid.,p.310.

61 Ibid.,p.311.

would be well worthwhile for the state to pay the salary of a director, as is often done in Americanization classes, leaving the industry to provide the work and the overhead....There is no more practical or less expensive method of providing for the large numbers of defectives who must remain in the community. It is our responsibility, by providing proper supervision and occupation we may be able to render them self-supporting, useful members of society."[62]

hen Stanley Marshall was making his study of the replacement of men by women in the plastic industry, he reported Walter Deitz, director of the War Manpower Commissions Training Within Industry, as saying, in essence "These plant training courses given by schools are especially beneficial for those who have never done factory work before. It gives them confidence in themselves so that when they enter the factory, their machine is not a mechanical monster that casts a paralyzing fear over them."[63]

It was ascertained that many of the children from the special classes in a nearby community went to work in one of the large shoe concerns after leaving school. The author, thinking it would be valuable to see these children actually at work, planned a visit to the shoe concern.

The superintendent of the plant kindly escorted her

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62 Elizabeth Bigelow, op. cit., p. 320.

63 Stanley Marshall, "The Replacement of Men by Women in Plastic Industry." p. 43.

through the factory. He remarked, "We do not have the intelligence quotients of our employees, and even if we had we wouldn't advertise the fact. I can, however, help you indirectly as we go through the rooms. All we require of a worker is that he is willing to do his best, follow instructions, and get the work done in a minimum of time with a minimum of waste."

he work was explained from bench to bench, and about one hundred selected men and women were questioned as to when they had left school, why they had left, how they had liked the work, whether they were interested in doing another kind of work. Only four of these who were questioned had been to school beyond the junior high school. When asked why they had left school, a few said they had left because of financial circumstances at home, but the majority said they had left because they did not like school or they had found school work too hard to be bothered with. Not one of these were interested in any other type of work. All were content to stay just where they were, doing the same job. Two men were pointed out. One man was earning sixty cents an hour; the other, doing the very same job, was earning one dollar an hour. The one earning the sixty cents an hour had been encouraged and even urged to earn more, but he was perfectly content to earn the minumum sixty cents which was paid for the work he was doing. This is characteristic of the

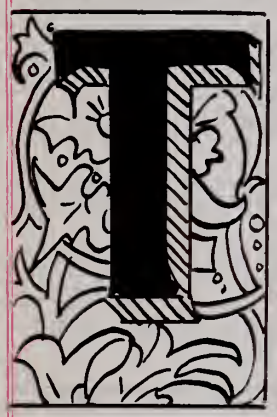
subnormal individual.

n one of the leading state institutions for the mentally handicapped, many members are trained and then sent out into the community to work. Some earn large wages; but no matter how much they earn, they are given only a small amount to take care of their immediate needs; the rest is put away for their future care. It has been ascertained that these people cannot handle money wisely.

Two men interviewed were definitely known to be subnormal, for army tests had shown this. They had been rejected by the army, but were serving their country, helping to make the army shoes. One girl was pulling out tacks from the shoes. (The tacks are put into the shoes the same as basting threads are put into a garment.) This girl had been tried on several jobs, but this was the only one she could handle; she had come from a special class and had been working at this job for three years. This was one of the essential odd jobs that must be done, so monotonous that a normal person wouldn't remain at it long. The factory was fortunate to have this girl. She was perfectly content and happy, humming to herself as she worked.

One hundred twenty-six operations are needed to make one pair of shoes. The superintendent said these individuals (fitting into the category of this study) could handle every operation but one, pattern cutting. A great deal of

intelligence and skill is needed in planning to cut the pattern parts from the whole skin. The operator must plan the layout of these patterns with a minimum of waste. When one realizes that ten thousand pairs of shoes are made in one day at this plant with a minimum of waste, one can appreciate the skill of these men.



he company has taken half of one of the spacious rooms for a classroom to teach the incoming employees how to handle the machinery. There is a forelady who acts as the class instructress. Each pupil is given all the individual help he needs to learn the work. The class has proved such a success that the employers are planning to use the whole room, which covers one side of the top floor of the building.

This has saved the company a great deal of money in materials and time. There is bound to be some waste while one is learning, but with supervision and individual attention, this waste is cut to a minimum.

Such a class would be especially valuable to the subnormal group. They need more time and attention than the normal person. With the right type of teacher who understands them, they would become the skilled workers any employer would find an asset to his plant.

The Ford Industrial Survey

In September, 1934, Edwin T. Ford, state advisor for vocational occupational training, came to the community to make a survey of all the local industries, "to provide a factual basis for suggestions, relative training possibilities in the general vocational department.....to provide students with a wide range of training opportunities and through an organized advisement service to help them make wise occupational choices."[64]

The significance of this survey to this study lies in the fact that the present plastic classes at the trade school are based on the findings of this study. At the time the survey was made, nearly all the pupils in the vocational school came from the prevocational and special classes. Not until about 1941, when the school changed from a vocational school to a trade school were other children interested in the school. The school was considered by members of the community to be a school for the mentally retarded. Now it is considered a trade school for all children interested in learning a trade.

The survey was made of all the industries in the locality between September, 1934, and September, 1935. The following questions were to be answered in the study. "What jobs do sixteen to twenty-one minors get?" "What are the specifications of these jobs?" "What are the best possibilities for

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64 Edwin T. Ford. "Report On the Guidance Project At Leominster." (October 14, 1935), p.1.

the boys, the girls?"

Data on five hundred thirty-six jobs was tabulated from the educational certificates. Employment information was secured on about sixty per cent of the five hundred thirty-six."[65]

After jobs were classified, Ford found that the celluloid and Novelty Companies predominated. Most of the girls were working in the garment manufacturing plants. He says, "The skilled jobs appear negligible. The semi-skilled jobs involving machine operations are predominate. Skilled trades in only two jobs, machine shop and pattern making."[66]

Celluloid and Novelties

Boys	Girls
Assembling	Assembling
Bevelling	Bending
Polking	Cementing
Polishing	Drilling
Pressing	Inspecting
Turning	Packing (Hairpins)
	Painting (Hand)
	Spraying
	Polishing

"In the large plants visited in the novelty industry, employment managers do the hiring. The work is permanent with seasonal lay off. Time to learn on these jobs listed varies from one to six months and the labor supply is casual; i.e.,

65 Edwin T. Ford, op.cit., pp. 3-5.

66 Ibid., p.6.

dependent upon the application of the individual initative. The age range for entrance to these occupations is from sixteen to eighteen to forty. Educational requirements showed only reading, writing, and counting. Patience and carefulness seem to be the common temperamental factors. Almost all jobs required manual dexerity, some required finger dexterity (cementing), and some demand an "A" rating in eyesight. (inspecting)."[67]

He continues to say, "Based on the factor of the numbers employed in the locality and that the jobs required one to six months to learn, and do not involve heavy expensive machinery, the best possibilities for boys seem to be bevelling, polking, polishing, and turning.

"The best possibilities for the girls seen to be assembling, cementing, drilling, hand painting, inspecting, packing hairpins, and spraying. With the exception of assembling, direct training would be necessary."[68]

The author, from actual experience in the factory, does not quite agree with all of the last statement made by Ford. Assembling includes such processes as drilling, stapeling, riveting, stitching, painting, spraying, dying, commercial stringing of chains and beads, also the attaching of jewelry parts to the chains. To become proficient for production,

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67 Edwin T. Ford. op.cit., p.7.

68 Ibid., pp. 6-7.

training is needed in the assembling department, in the opinion of the author.

The following table shows the jobs secured by minors sixteen to twenty-one taken from the employment certificates issued during the year September, 1934, to September, 1935, and still in force October, 1935.

Plastic Group

Ashing*	Inserting	Sanding*
Assembling*	Inspecting*	Sorting*
Bending*	Labeling*	Spraying*
Bristling*	Linkwork*	Stamping*
Buckel Work*	Picking Bristles*	Stringing*
Buffing	Plating*	Striping*
Cementing*	Plugging	Swedging
Dipping*	Polking	Tickeling*
Drilling*	Punching	Toothbrush Work*
Filing*	Repairing*	Tumbling
Frazing*	Safety Glasswork*	Turning

[69]

*Work that can be performed by girls."

The author would like to say here that nowadays both men and women operate the swedging and polking machines. There is one more item on the above table that raises a question in the mind of the author. Ford says that frazing was a job for girls, too. This may have been true when he made the survey, but until the present war situation there was a law saying that girls could not handle the frazing machines. The author wished to learn to operate the frazing machine when she began her work as designer in one of these plastic companies. It was not allowed and she had to do her carving with

69 Edwin T. Ford. op.cit., p.9.

hand tools.

The result of the Ford study was that the school board decided to equip an adequate workshop in the trade school to give vocational training to the boys. The estimated cost was about four hundred dollars. Machinery needed: a jug saw, a turning lathe, a bench, a polking machine, drills, three spray guns, two ash and polishing spindles, a beveling machine, a comb cutting machine and a surface grinder. The final outcome was that many of the machines were proffered by local industries and a workshop was set up in the school. Materials have been generously supplied by the owners of many of the local factories.

For the past seven years plastics have been taught to boys at the trade school. As a result of this present study there is to be a plastic class for the girls next fall, for the plastic industry has grown since Ford made his study in 1935. At the time of his survey in 1934, there were seven plastic plants; now there are sixteen, employing most of the working populace.

CHAPTER III

PROCEDURE OF THE STUDY

The Normative Survey and the Experimental methods were used in this investigation.

The first step in setting up the experiment was a survey of the one hundred seventy-five children who had left the prevocational classes in the six years between September, 1937, to September, 1943. There were one hundred four boys and seventy-one girls; all were located but four who had moved from the community.

Out of the one hundred and seventy-five, one hundred forty-six were working in industry. One hundred thirty-six of these industrial workers were working in the plastic industry. Six girls were working in other industries; one in a slipper factory in a near-by community; the other five in one of the local garment factories, stitching. Four boys were located in other industries: two in a furniture factory, upholstering; the other two in a leather company in a near-by town.

Ten boys and nine girls were not working. One of these boys had worked in three plastic companies in the past five years. Owing to a tubercular condition he had to stop work and was given a home permit. One of the girls was in domestic service; two boys, in farm and dairy work; two boys and one girl, in institutions for delinquents.

TABLE I A SURVEY OF ONE HUNDRED SEVENTY-FIVE BOYS AND GIRLS, FORMER PREVOCATIONAL CLASS PUPILS WHO LEFT SCHOOL BETWEEN SEPTEMBER, 1937-SEPTEMBER,1943

Where Located	Boys	Girls	Totals
Plastic Industry	84	52	136
Other Industries	4	6	10
Domestic	0	1	1
Farm and Dairy	2	0	2
Not Working	10	9	19
Moved Away	2	2	4
Delinquents	2	1	3
Totals	104	71	175

The next step was to locate the places where these children were working in the plastic industry and to learn what specific job they were handling. This was done through a survey of the working certificates and personal interviews. All were located in eighteen different plastic companies, six local and two in a near-by community.

This large group of one hundred thirty-six was now divided into three smaller groups, for the author found that fifty-one of the boys had received some training in plastic work during their formal education while at the trade school. Thirty-three boys had had no training and the fifty-two girls were untrained. Group one, the boys with training, was compared with group two, the thirty-three boys untrained, and

the third group, fifty-two girls who had not been trained.

TABLE II INDUSTRIAL TRAINED GROUP OF BOYS
THEIR I.Q.s AND THE JOBS THEY ARE HANDLING

I.Q.s	NUMBER										TOTALS
95-96			1								1
92-94						1					1
89-91					2	2	1	1	2		8
86-88					2	2	1	1			6
83-85						1	2	1	4		8
80-82			1		1	2	3	1	1		9
77-79						2		1			3
74-76					1	1	1	1			4
71-73							1	1	1		3
68-70					1	2	1		2	1	7
65-67											
62-64											
59		1									1
JOBS	Molding	Floor Boy (Hot water Dept.)	Packing Room	Assembling	Jig Saw and Frazing	Swedging Presses	Polking Press	Tumbling	Ashing Polishing	Errand Boy	
TOTALS	0	1	2	0	7	13	10	7	10	1	51

TABLE III BOYS, UNTRAINED GROUP, I.Q.s AND JOBS HANDLED

I.Q.s	NUMBER										TOTALS
95-96											
92-94											
89-91					1	1					2
86-88					1		3	1			5
83-85						2		1			3
80-82			1			4	1		1		7
77-79			1			3					4
74-76		1			1		1	1	1		5
71-73		1									
68-70							2	1			3
65-67	1								1		2
62-64											
59-61									1		1
JOBS	Molding	Hot water Dept.	Packing Room	Assembling	Jig-Saw and Frazing	Swedging Presses	Polking Press	Tumbling	Ashing & Polishing		
TOTALS	1	2	2	0	3	10	7	4	4		33

Their I.Q.s were tabulated from the school files. Each I.Q. was taken from an individual test record given by the

state psychologist or grade supervisor.

TABLE IV THE GIRLS IN INDUSTRY....I.Q.s AND JOBS HANDLED

I.Q.s	NUMBER											TOTALS
95-96	1						1				1	3
92-94										1	1	2
89-91										1	2	3
86-88	1	2						2		1		6
83-85								2		3	2	8
80-82							1	1		2	2	8
77-79										1		1
74-76						1	1		4	2	3	11
71-73					2					1	1	4
68-70												0
65-67				2					1	1		4
62-64									1			1
60									1			1
JOBS	Inspecting	Begaling	Jig-Saw Frazing	Dye Room	Hot-water Dept.	Ashing Polishing	Rolling Presses	Swedging Presses	Spraying	Painting	Assembling	
TOTALS	2	5	0	2	2	1	3	5	7	13	12	52

JOB ANALYSIS

he next step was to analyze each job in the factories, for not all plastic companies have the same products. A visit was made to factories that made the following articles: jewelry and novelties, hair brushes and toothbrushes, combs and toilet articles, cosmetic cases, compacts, lipstick containers, powder boxes, jewelry boxes, umbrella handles and umbrella tips, knitting needles, sun glasses, radio knobs and cabinets, automobile fixtures, kitchen utensils, toys and Christmas tree ornaments.

The machines listed here are the machines the children were handling in the various factories. There is no significance in the order as described; all are of equal importance in the production of the goods.

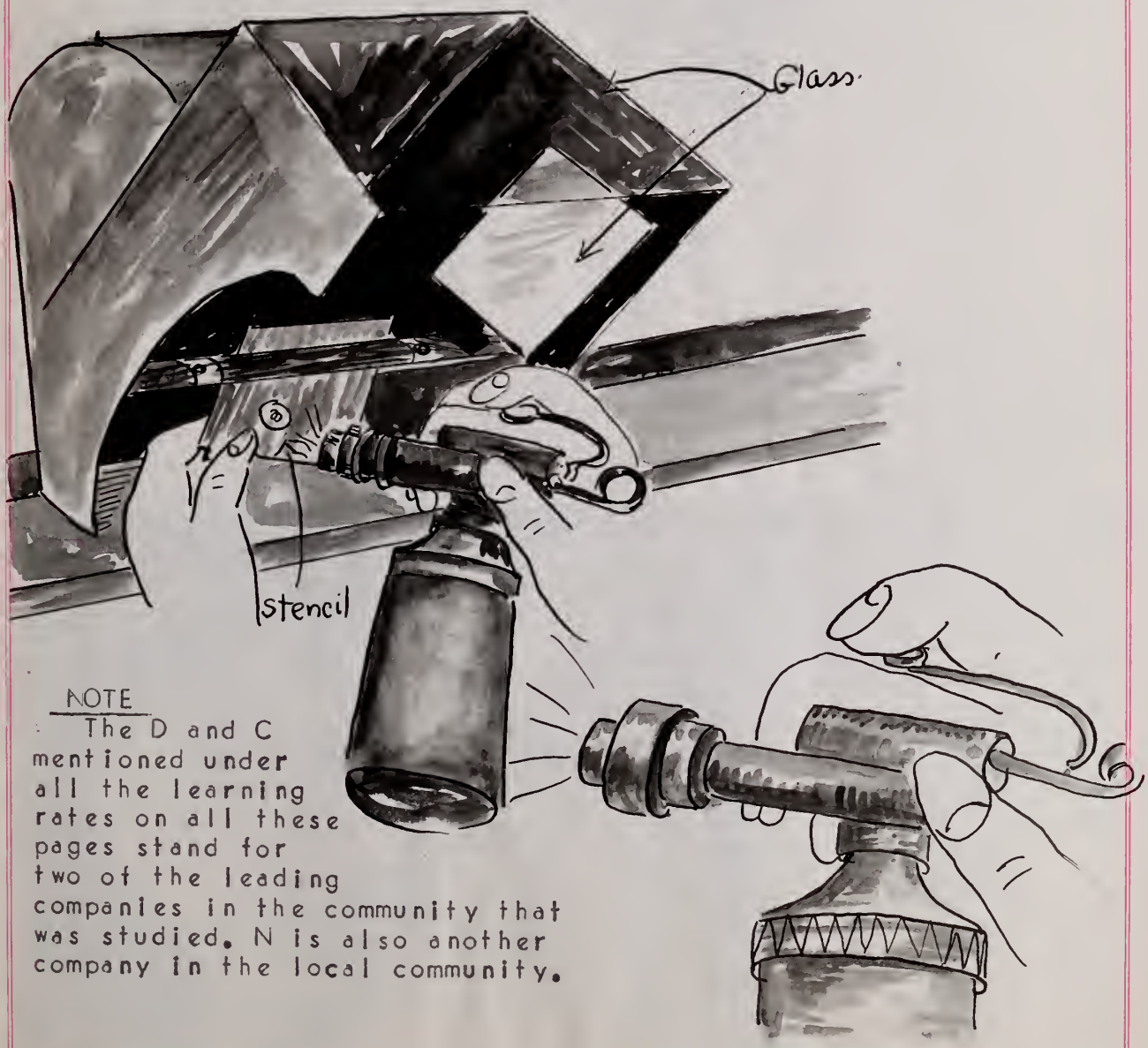
The learning rate given under each process is the time required to become proficient in production work. This information was given to the author by men whose knowledge was based on years of observation and experience in the timing of workers. The timing from the trade school was based on seven years spent in the plastic workshop.

The assembling department has many smaller departments. The majority of the workers employed in these departments are women. Such machines as the stapeling machines, the riveting machines, and drilling machines are used in this department. Other processes in assembling are done by hand, such as stringing, spraying, cementing, and dying.

Spraying

This is a very dirty job, a girl's work. She must know how to load and condition a spray gun, and she must clean her stencils. She holds the work with her left hand and operates the gun with her right. There is a knack of using the gun. The girl must not shoot directly at the object, but aim a little below and with an upward swing of the wrist to give the right texture of color.

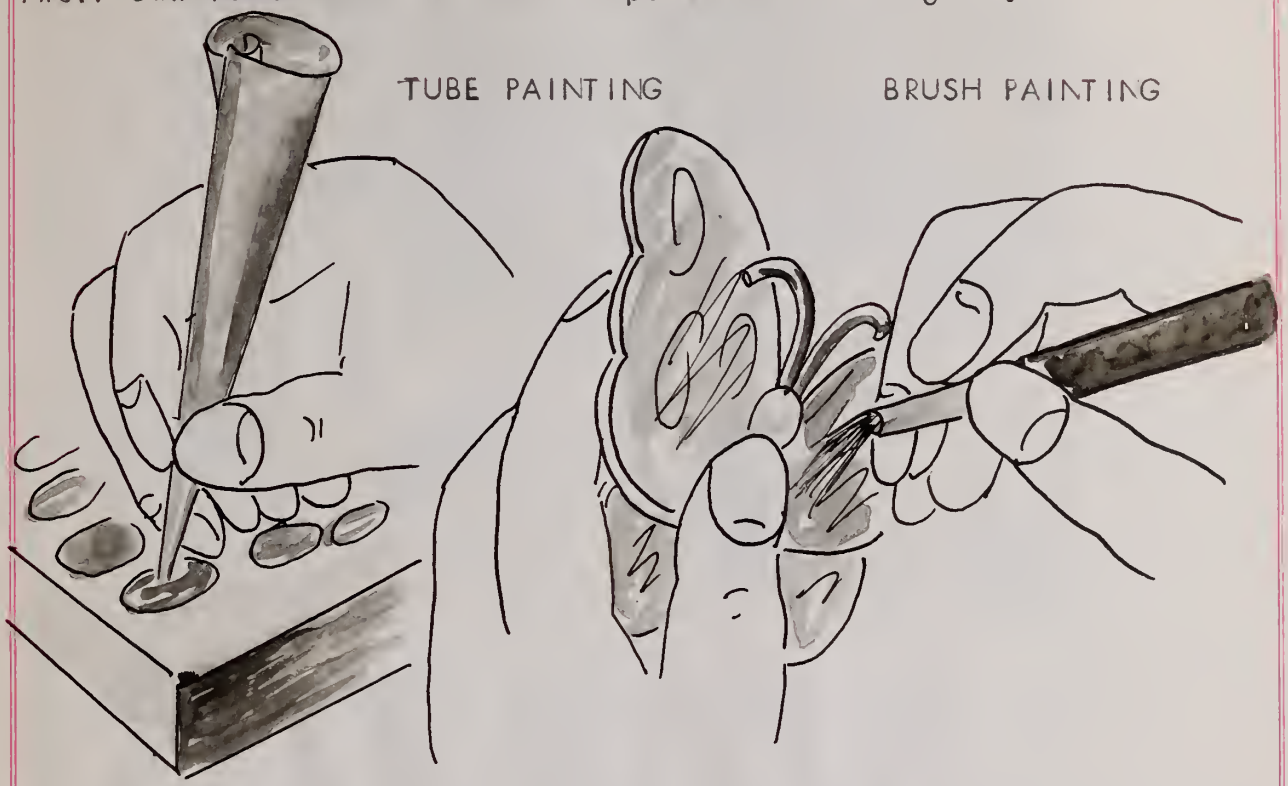
Learning time: D—, 2-3 months; trade school, 2-3 months; C—, 6-10 weeks. In normal times twenty-five girls are employed in this department in one of the novelty companies.



NOTE
The D and C mentioned under all the learning rates on all these pages stand for two of the leading companies in the community that was studied. N is also another company in the local community.

PAINTING DEPARTMENT

Two kinds of painting are done at the bench. One is done with the paint brush; the other, with a tinfoil tube. The girls roll their own tubes into a cone shape with the fingers.



The paint is diluted with acetone if painting on plastic. Use budel when painting on wood. The picture, below, shows a girl painting buttons. The shank of the button fits into a groove on the wooden tray to hold it firm.

Novelties and jewelry are generally held in the hand as the above sketch shows. Sometimes the painter prefers to lay her work on the bench, holding it in place with her hand. Both types of painting are used.

Learning Time

"D"..Three months
"C"..Three to four months.
"T.S."..Two to three months.

In normal times "C" hires as many as fifty girls to work in this room.

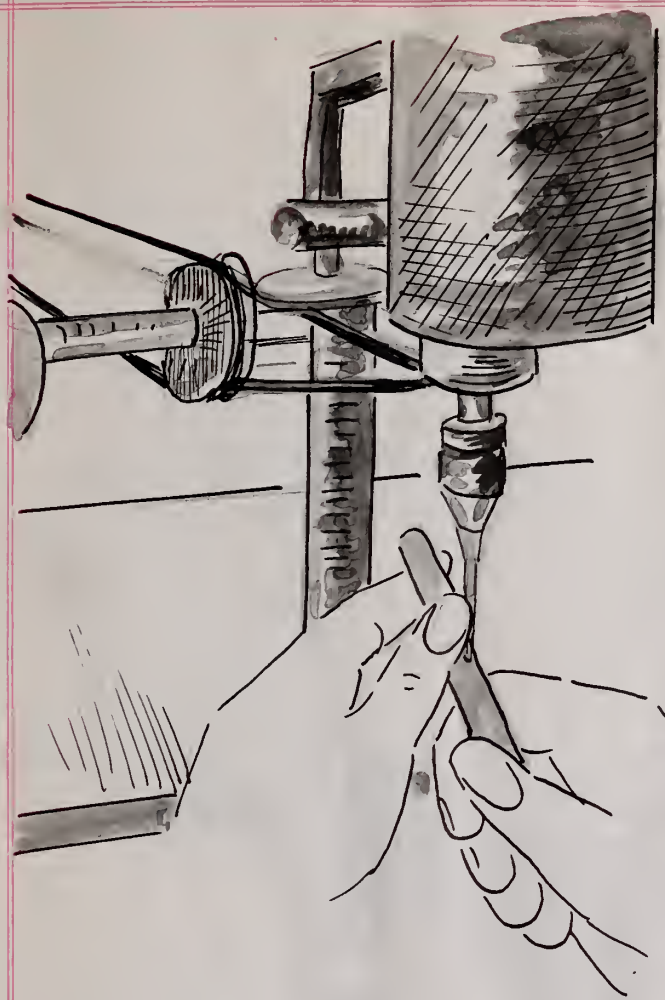
Cementing Department

Cementing is done by hand. The pieces are held together, sometimes with the fingers, sometimes with snap clothes pins. Acetone is used on the acetate plastics; a heavier cement is used on the conda perl and the lucite. The only danger is to the clothing if the fabric is made of rayon, this being a form of acetate plastic. Acetone is a form of plastic and melts the rayon threads. When parts are to be cemented, the acetate blends them into one piece. Acetone is a colorless liquid and will only have a drying effect on the hands; it is harmless. Acetone will take off the nail polish from the fingernails. The nail polish is also made from acetate plastic.

Learning Time

"D"....Four weeks;
"C"....Four to six weeks;
Trade School....Two to three weeks.

Women from sixteen to forty are hired to work in this department. In one of the novelty factories, in normal times, they hire forty workers.



Drilling

Employers interviewed said they preferred experienced help in this department. Great care must be taken for there is danger of drilling the fingers. The drill operates by turning the electric switch which is under the bench table top.

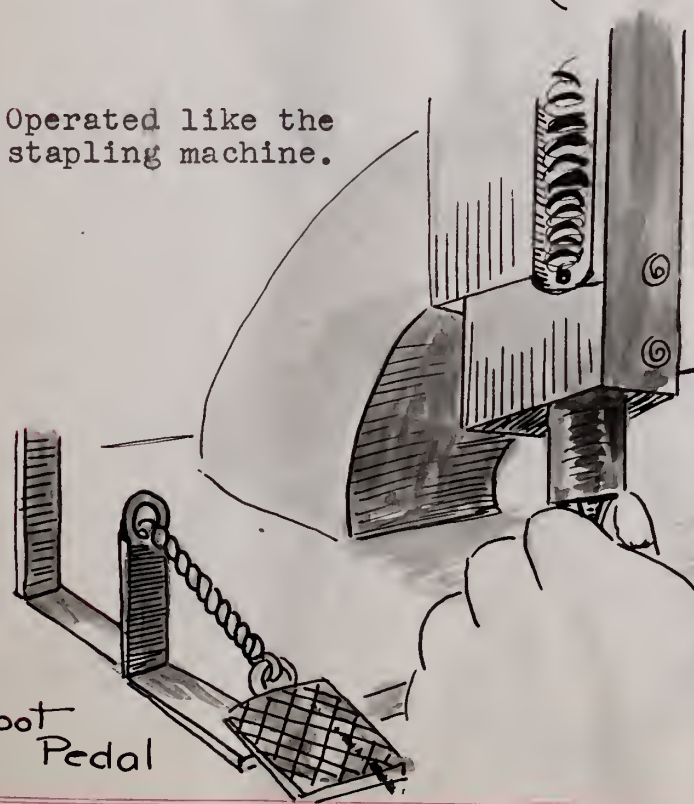
Time needed for learning: D—, 6 weeks; trade school, 3-4 weeks; C—, 4-6 weeks.

There are double drills, too. These are needed especially to put on pins.

In normal times C— can use twenty people (men and women) in this department.

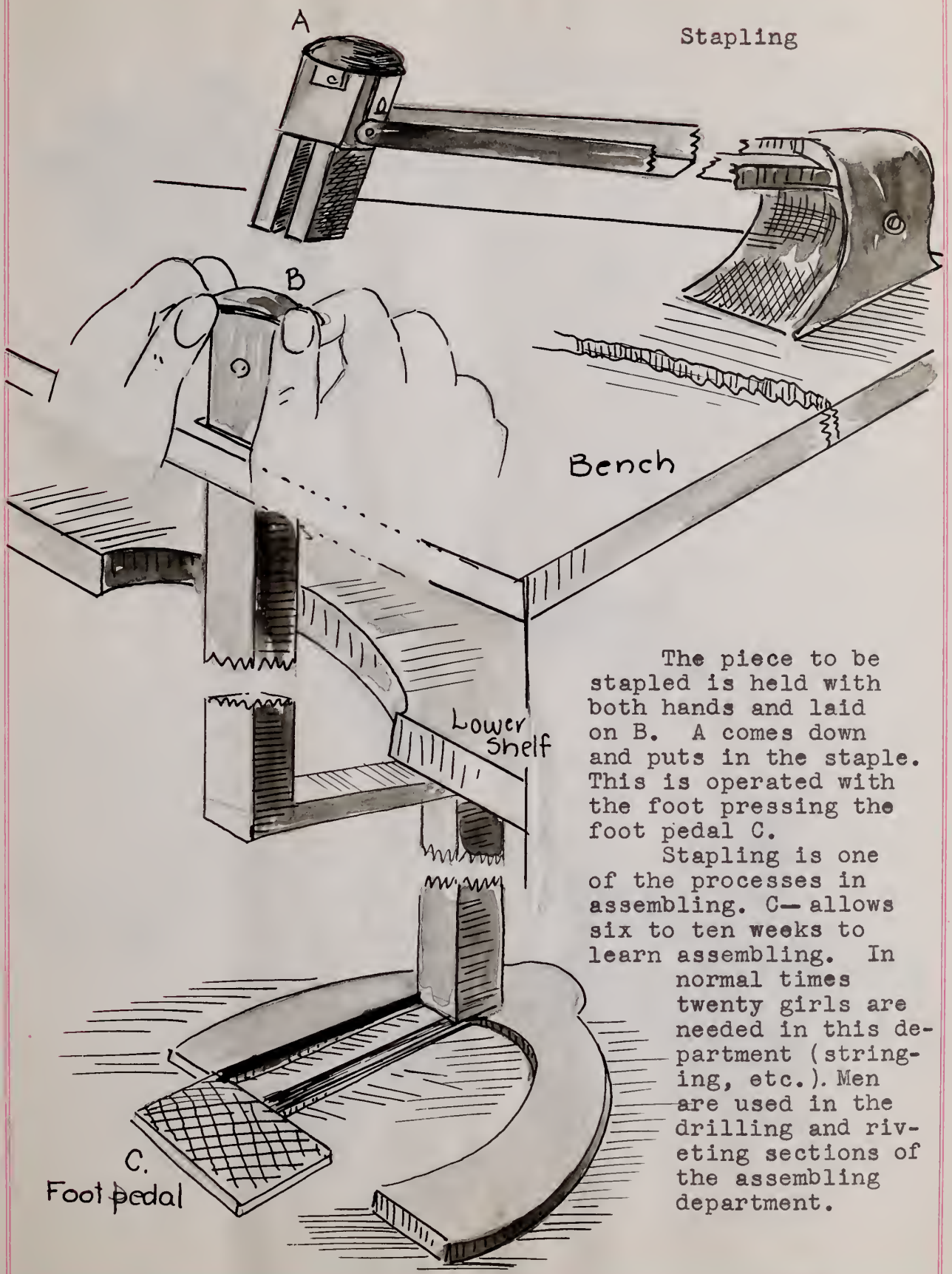
A Pin Press

Operated like the stapling machine.



The article is held with the left hand. The pin is brought over with the right hand. The press comes down on to the pin. It is operated with the right foot. The pin is pressed in after the holes have been drilled in the body of the pin.

Stapling



The piece to be stapled is held with both hands and laid on B. A comes down and puts in the staple. This is operated with the foot pressing the foot pedal C.

Stapling is one of the processes in assembling. C— allows six to ten weeks to learn assembling. In normal times twenty girls are needed in this department (stringing, etc.). Men are used in the drilling and riveting sections of the assembling department.

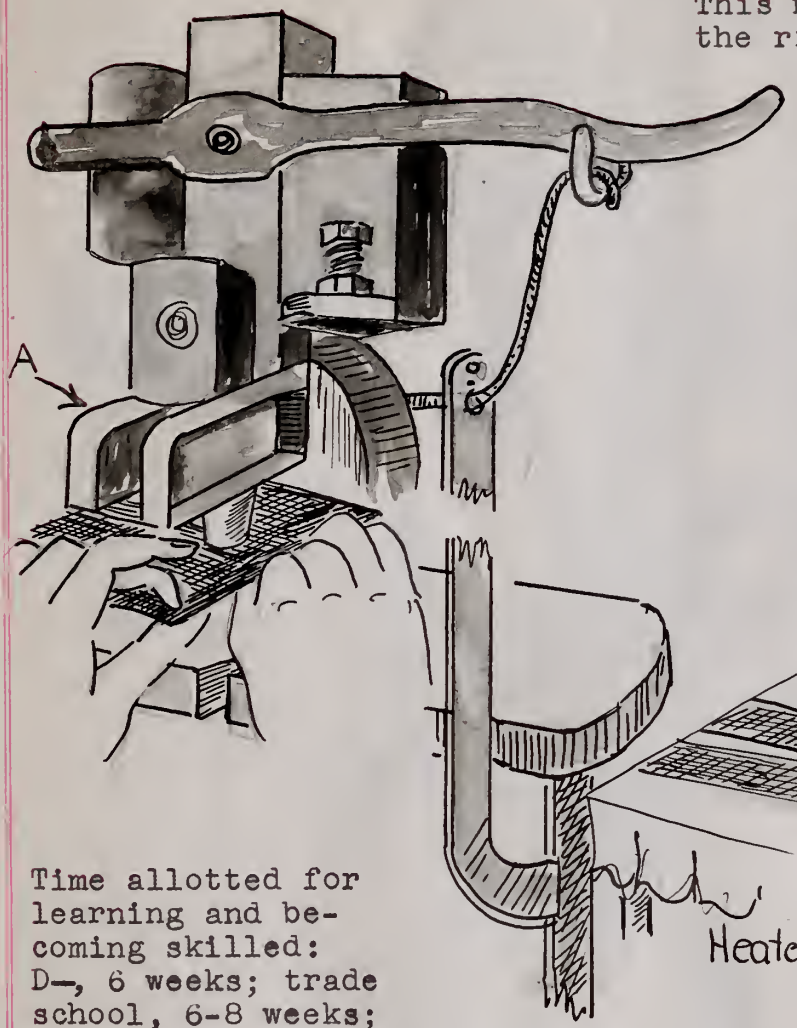
Polking or Blanking

This machine is operated by the right foot. The pedal goes up and down, bringing the polking cutter down on the material which is held with both hands.

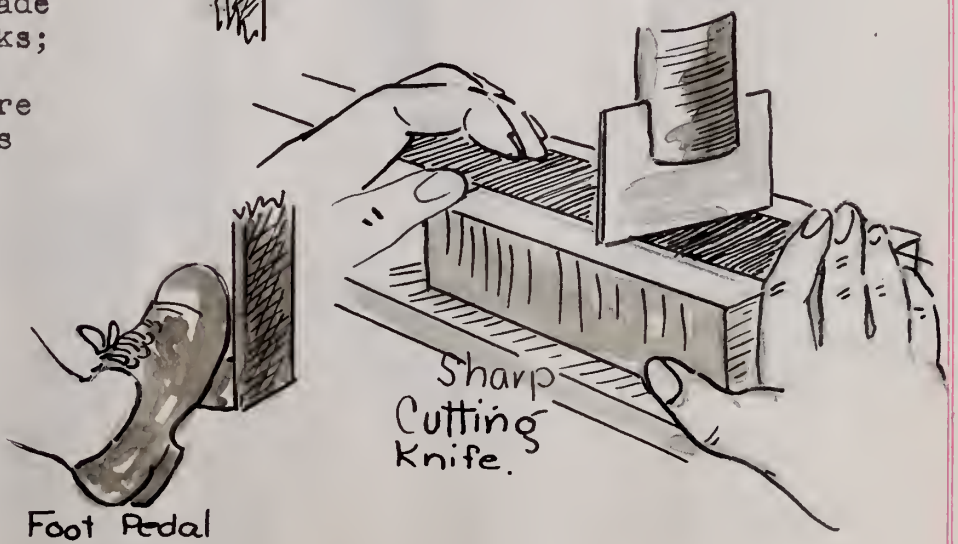
The knife, shown below, is inserted in the same machine at A.

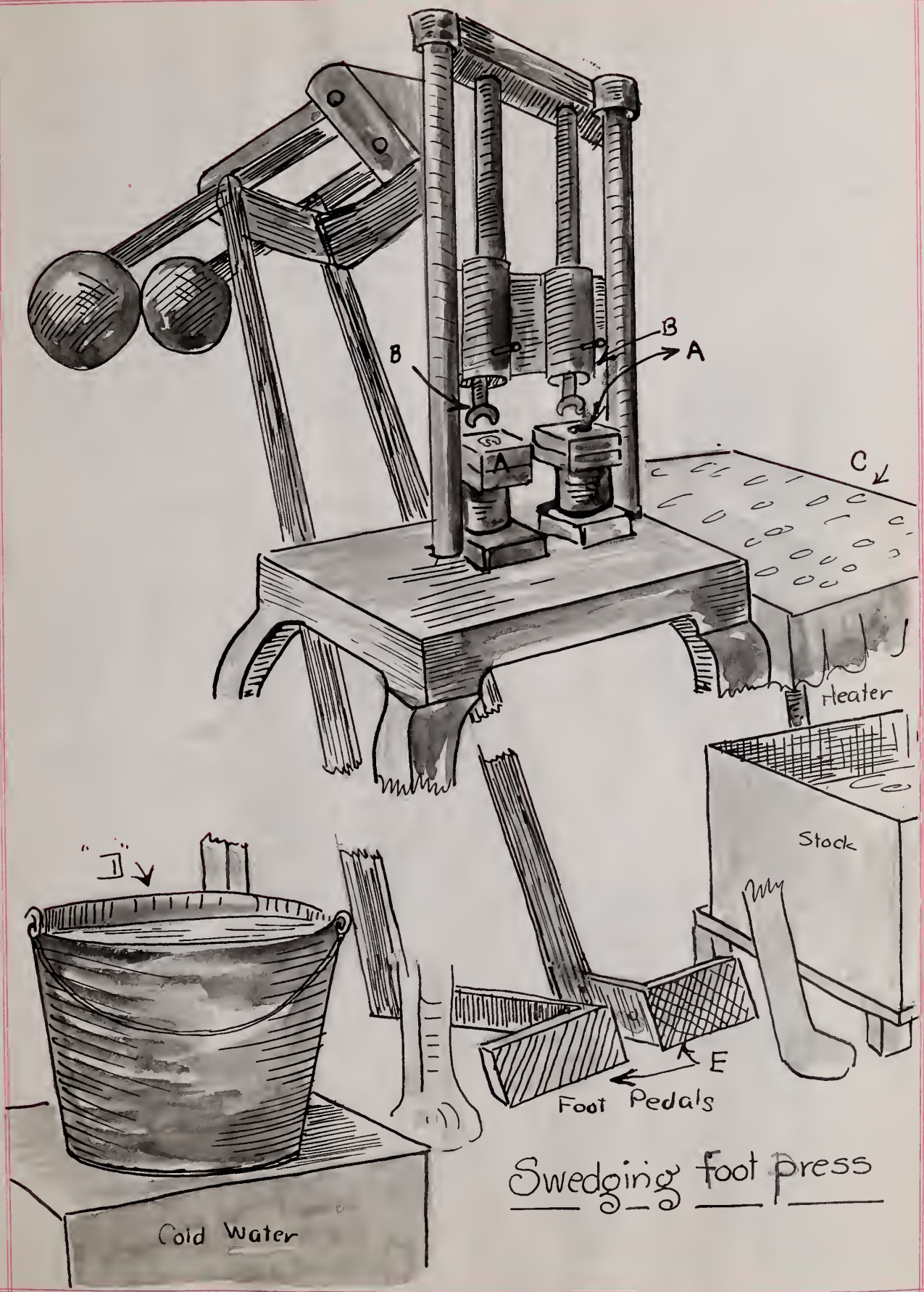
The cutters are very sharp. Care must be taken so as not to cut the hands.

Both male and female operate these machines. The men, however, take care of sharpening the cutters.



Time allotted for learning and becoming skilled: D—, 6 weeks; trade school, 6-8 weeks; C—, 6-8 weeks. Twenty people are employed in this department in normal times.





Swedging foot press

To operate the swedging machine, pictured on the preceding page, the operator sits, placing a foot on each pedal, the heel hanging over the back of the pedal E. This is a double swedging machine. Each foot controls a side.

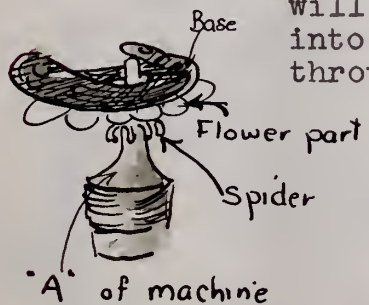
The material is taken from the box on the right, placed on the heating table C. When pliable, the piece is put on A, the die, with the right hand. The right foot pushes the pedal forward, bringing the top part of the die B down onto A. Now she places another piece on the other die at the same time, taking the shaped piece off A after releasing B, and with the left hand she drops the piece into the pail of cold water at her left.

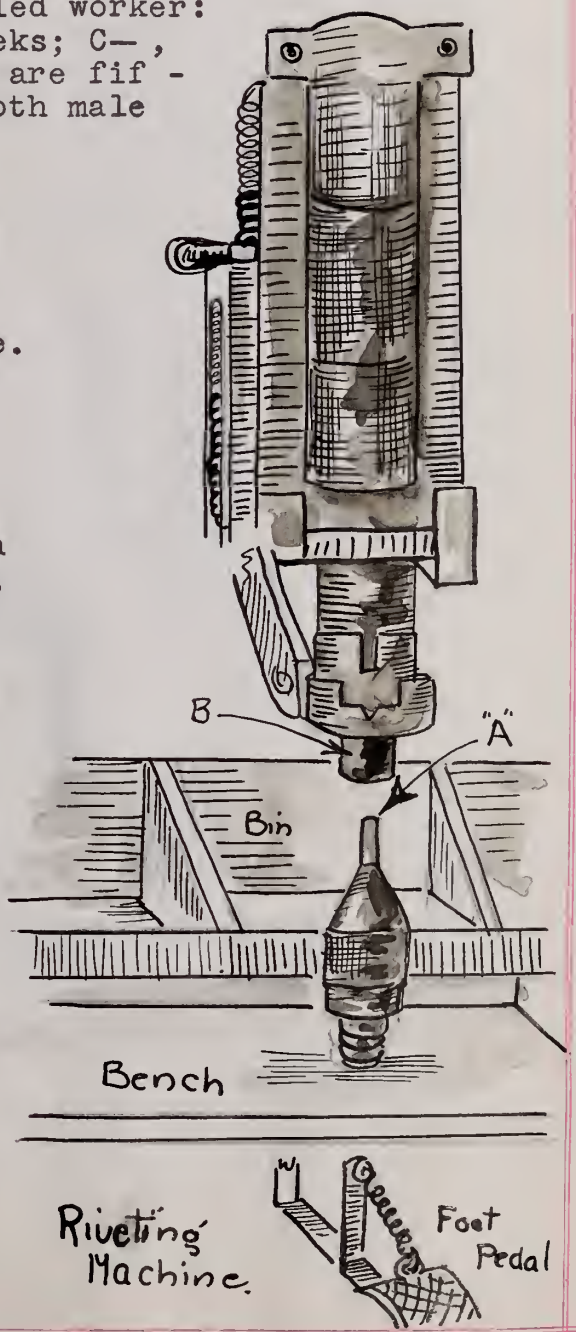
Time needed to become a skilled worker: D—, 6 weeks; trade school, 6-8 weeks; C—, 6-8 weeks. In normal times there are fifteen people in this department, both male and female.

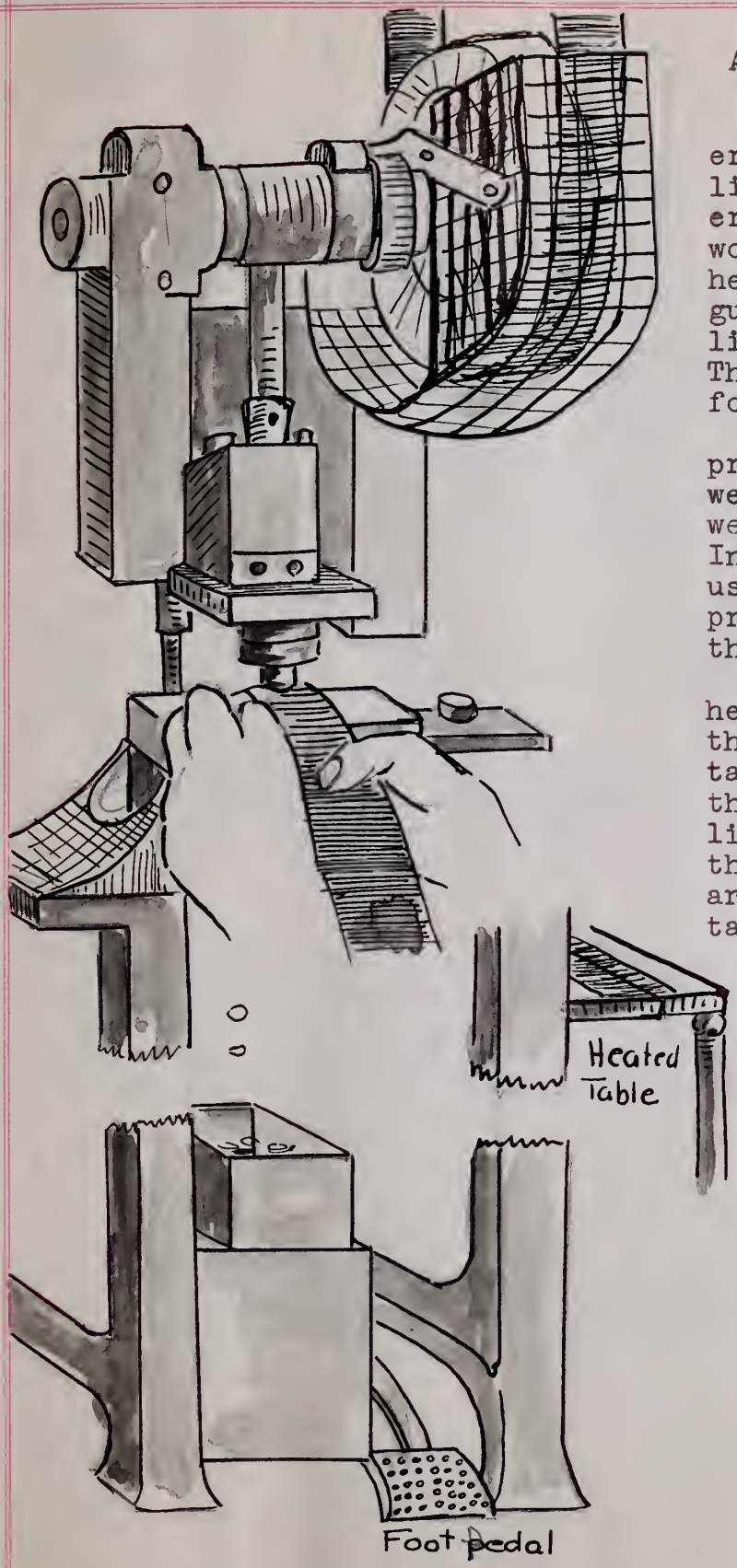
Automating Riveting Machine

The rivets are in the machine. The machine is operated like the stapler, pin press, etc. It is controlled with the right foot pressing down on the foot pedal.

For stone setting, you need a spider. Place spider on A, then flower part, then base. Now press foot on the pedal, and rivet will be driven into the parts through B.







Automatic Power Press

This machine is operated by the men. The lighter presses are operated by both men and women. The material is held in both hands and guided under the cutter like a sewing machine. This is controlled by the foot pedal.

Learning period of press machines: D—, 6 weeks; trade school, 6-8 weeks; C— , 6-10 weeks. In normal times C— can use fifteen people on the press machines, including the foot swedging press.

The material is heated at the right of the operator on heated tables, then put through the machine. The danger lies in the cutting of the fingers,as the dies are sharp. Care must be taken not to put the fingers too near the cutters.

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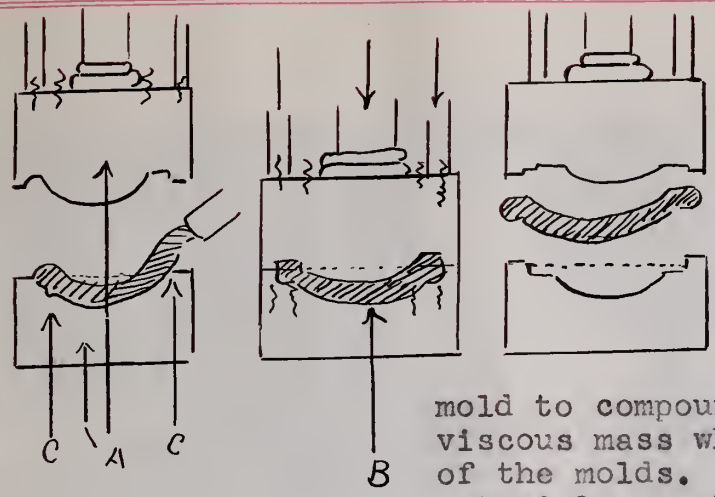
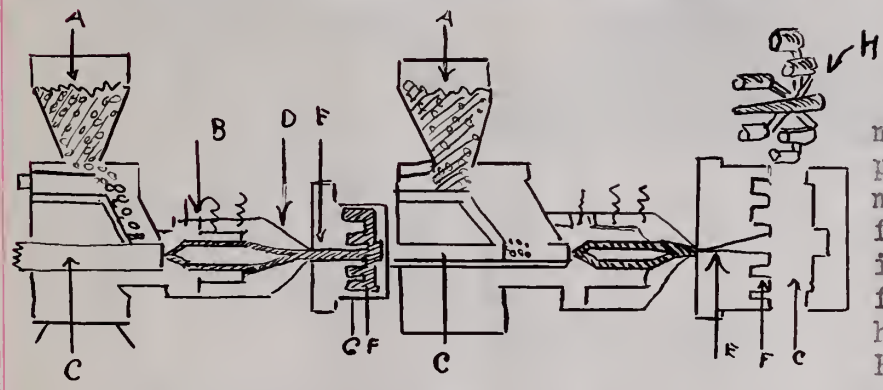


Compression Molding

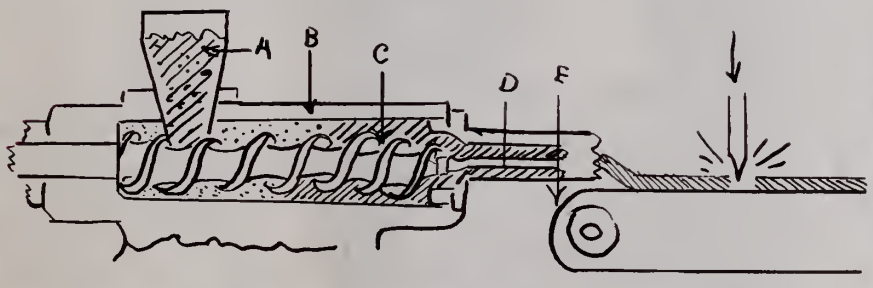
This is used for thermosetting plastics, a baking and pressing process.

A is the place where the powder is put (pre-heated polished steel molds). As molds close, heat is transformed from mold to compound (B), softening it to a viscous mass which flows to all parts of the molds. With the thermosetting materials, a short cure in heated molds is necessary to permanently harden molding compound.



Injection Molding

This is a method for thermo-plastics. Powdered molding material is fed automatically in exact quantities from hopper (A) into heating chamber (B). Here heat transforms powder into freely flowing, near-liquid mass which is forced by ram (C) through nozzle (D) into passage or spruce (E), then through runners (F) into cold cavities (G) where it solidifies in shape of mold. These machines open automatically. The operator closes the gate after removing (H) from the machine.



Extrusion

This works like injection molding. The material comes out like tooth-paste. Material in (A) (B) where granulated pieces become semi-liquid, is forced by mechanical screw (C) through die shape (D) onto the conveyor (E) which travels at a regulated speed. As strips cool, these are cut (F). This part of the job, the subnormal, is ideally fitted for. The machine runs automatically. The engineer sets it up.

Above diagrams copied from "Monsanto Plastics" .

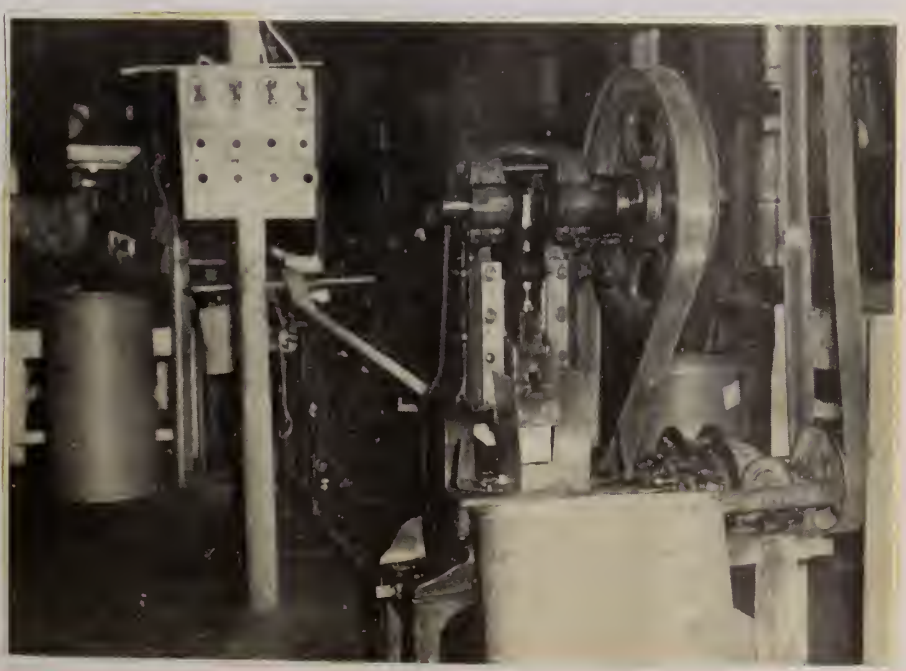
Injection Moulding

This machine works automatically. When the product is ready to be removed the door opens. The picture shows the girl just as she has removed the buttons from the machine. Her right hand is on the door ready to close the machine. When the door is open the machine is stopped. If you look carefully you can see the steel die inside the machine. The process is like filling cookie shapes. The gate on the molded part is the vein of the product. The operator removes the part by gate handle.

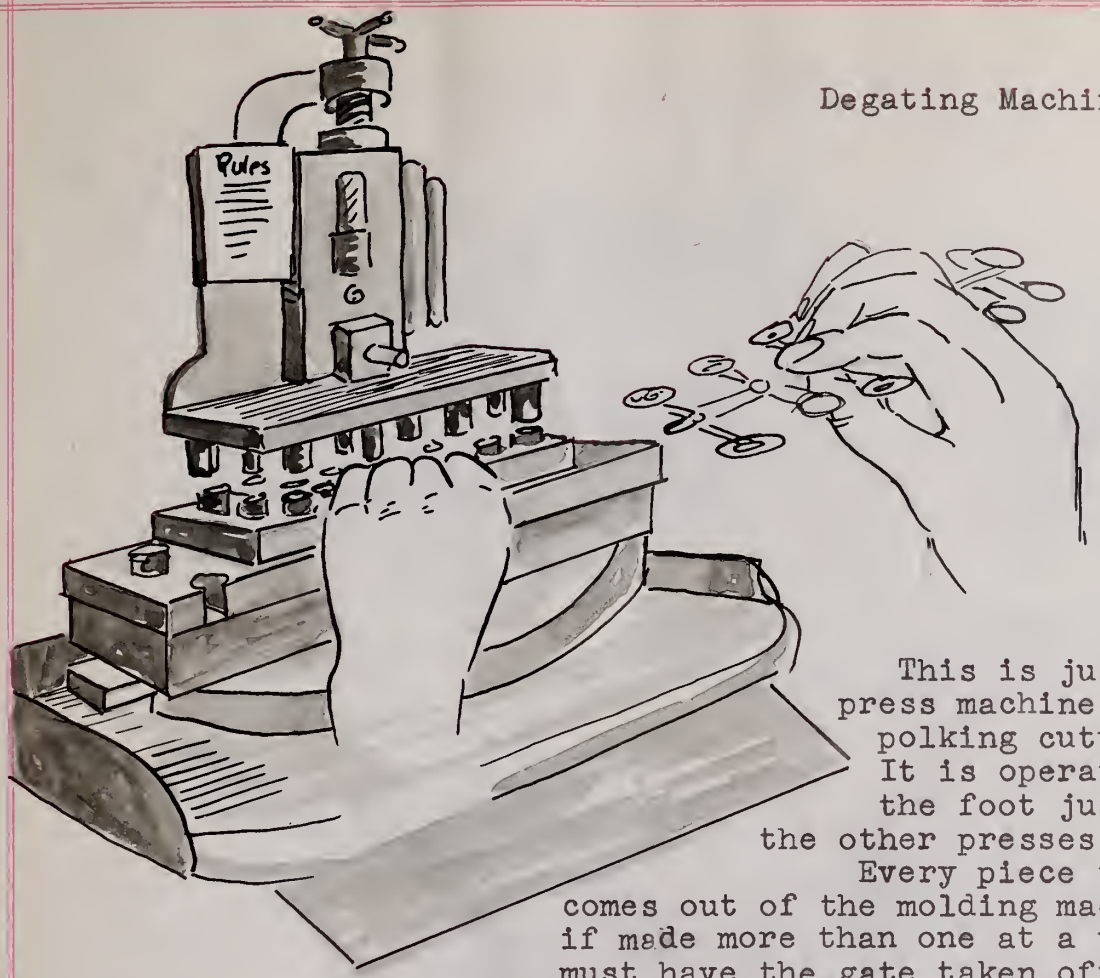
Extruding Machine

This machine operates entirely automatically. Once it has been set up it will continue to run, while the power is on, until the hopper is emptied of powder. Dies are used to regulate the width of the strip which comes out of the machine as toothpaste comes out of the tube.

A man is needed to cut the strips into the desired lengths. The material made on this machine is used in the polking or blanking, as it is sometimes called, department.



Degating Machine



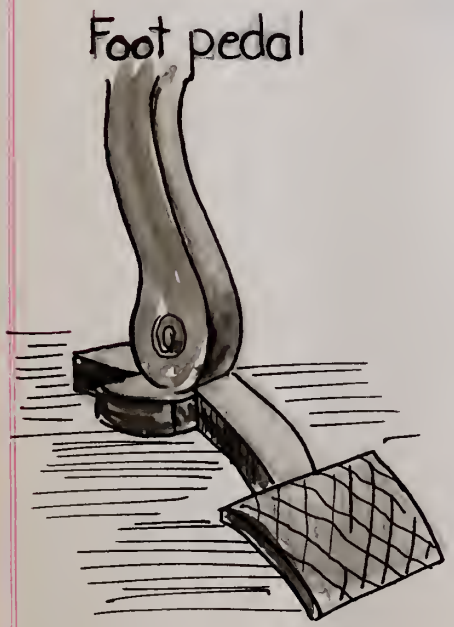
This is just a press machine with polking cutters. It is operated with the foot just like the other presses.

Every piece that comes out of the molding machine, if made more than one at a time, must have the gate taken off. The above illustration shows the position of the hands with buttons on the gate.

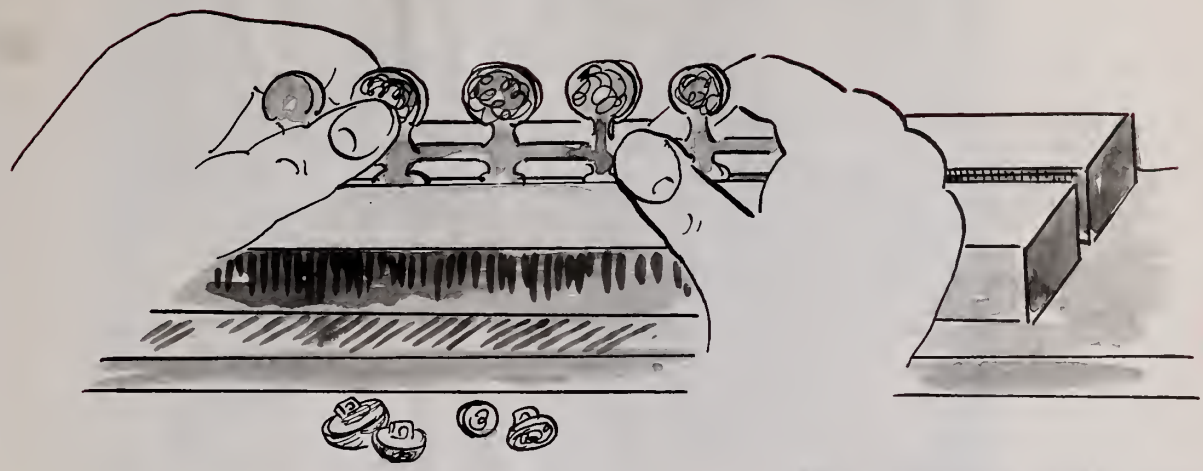
Degating is also done between two boards,as shown on the next page.

The stones are done by hand snipping (See next page.)

Some degating (while the molder waits for the machine to open) is done by the fingers alone, a slow process, but no time is wasted while working. The molder prefers this to waiting and doing nothing between times.



Degating between Boards



The buttons fall into the operator's lap, under the table.

Degating by Hand Snipping

Hand Snipping

The stones are connected to the gate with a small bridge. This bridge must be cut by hand. The bridge is needed as an air vent so as to prevent bubbles in the stones.

The cleaning of the dies for the jewels is important, and one girl just polishes the inside of the dies, for they must be absolutely free from even a speck of dirt before inserted into the molding machine.

This is good work for one of the girls of the type this thesis is written about.

DEGATING BUTTONS, BOARD METHOD

GRINDING MACHINE

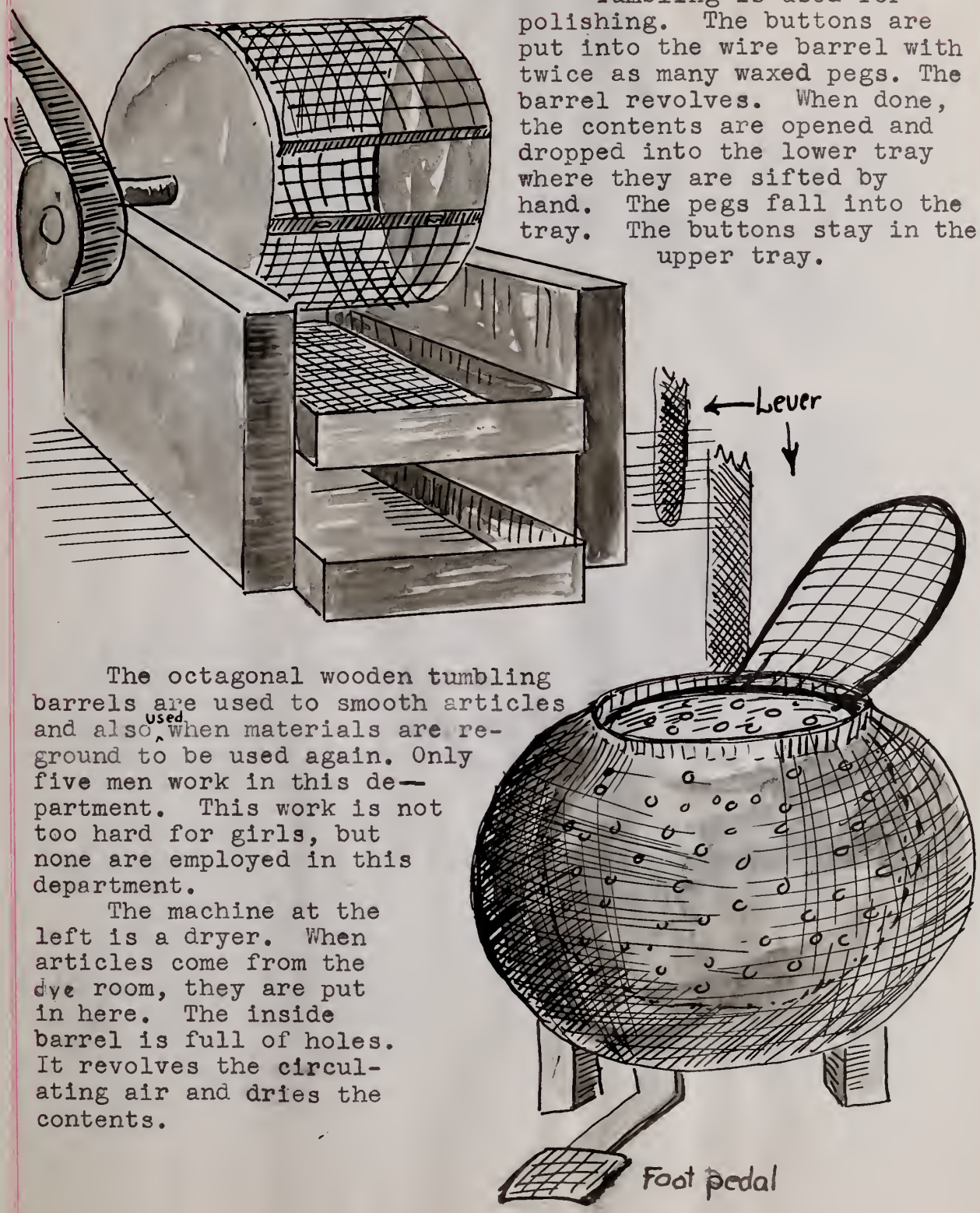
The material being fed into the hopper is the part the girls are breaking away from the buttons. This is called the gate. The material is ground into powdered plastic. Then it is sent to the experimental laboratory where the chemist experiments with this colored scrap of many colors, to see how it can be redyed one color to be used again. It is then sent to be run through the extruding machine, pictured on the following page. The waste comes out in strips, similar to toothpaste from the tube. Now it must be reground once more into powdered crystal form. Then it is sent to the moulding department to be used.

All the acetate scrap can be used over and over again. Nothing is wasted. In one of the leading plants, it was learned, that two-thirds of the products are made from the scrap.

Lucite does not react this way and much material is wasted. The chemists are trying to find a way to eliminate the waste.

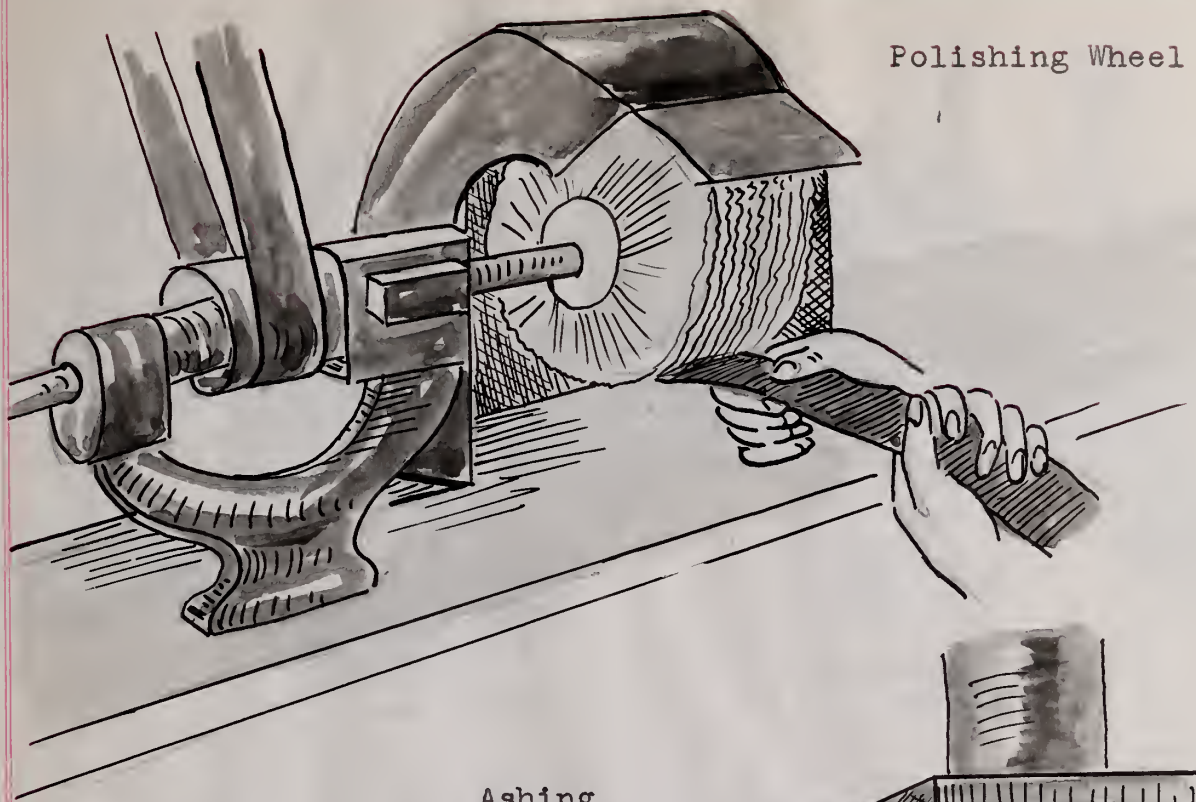
Tumbling

Tumbling is used for polishing. The buttons are put into the wire barrel with twice as many waxed pegs. The barrel revolves. When done, the contents are opened and dropped into the lower tray where they are sifted by hand. The pegs fall into the tray. The buttons stay in the upper tray.



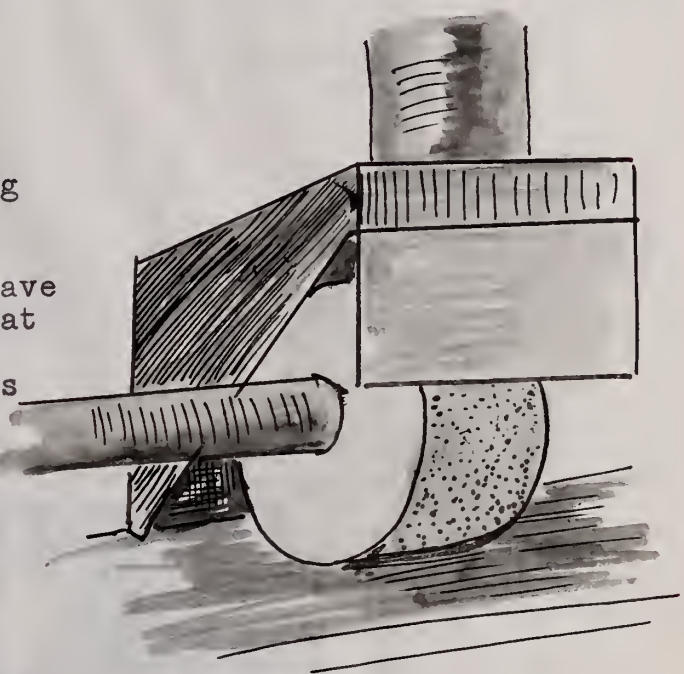
The octagonal wooden tumbling barrels are used to smooth articles and also used when materials are reground to be used again. Only five men work in this department. This work is not too hard for girls, but none are employed in this department.

The machine at the left is a dryer. When articles come from the dye room, they are put in here. The inside barrel is full of holes. It revolves the circulating air and dries the contents.



Polishing Wheel

Ashing

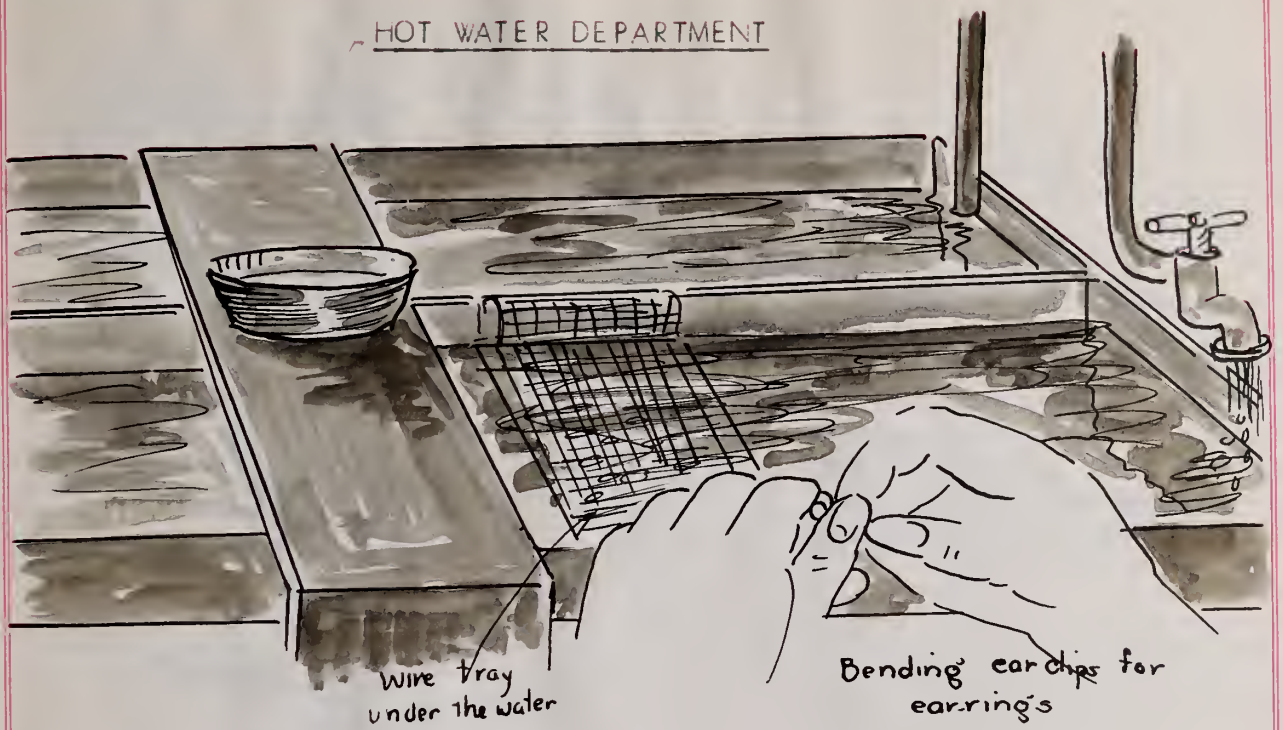


Ashing and polishing have the same routine except that in ashing the wheel is a hard cloth wheel. Pumice is used on the object. This process takes off scratches and makes the surface smooth.

In polishing, a polishing compound is used and a soft wheel of cloth.

Time to learn: D—, 6 weeks; N—, 6-8 weeks. Only six or eight people are needed in this department because this process is used only for wood and catalin products. The majority of plastic work is molded.

HOT WATER DEPARTMENT



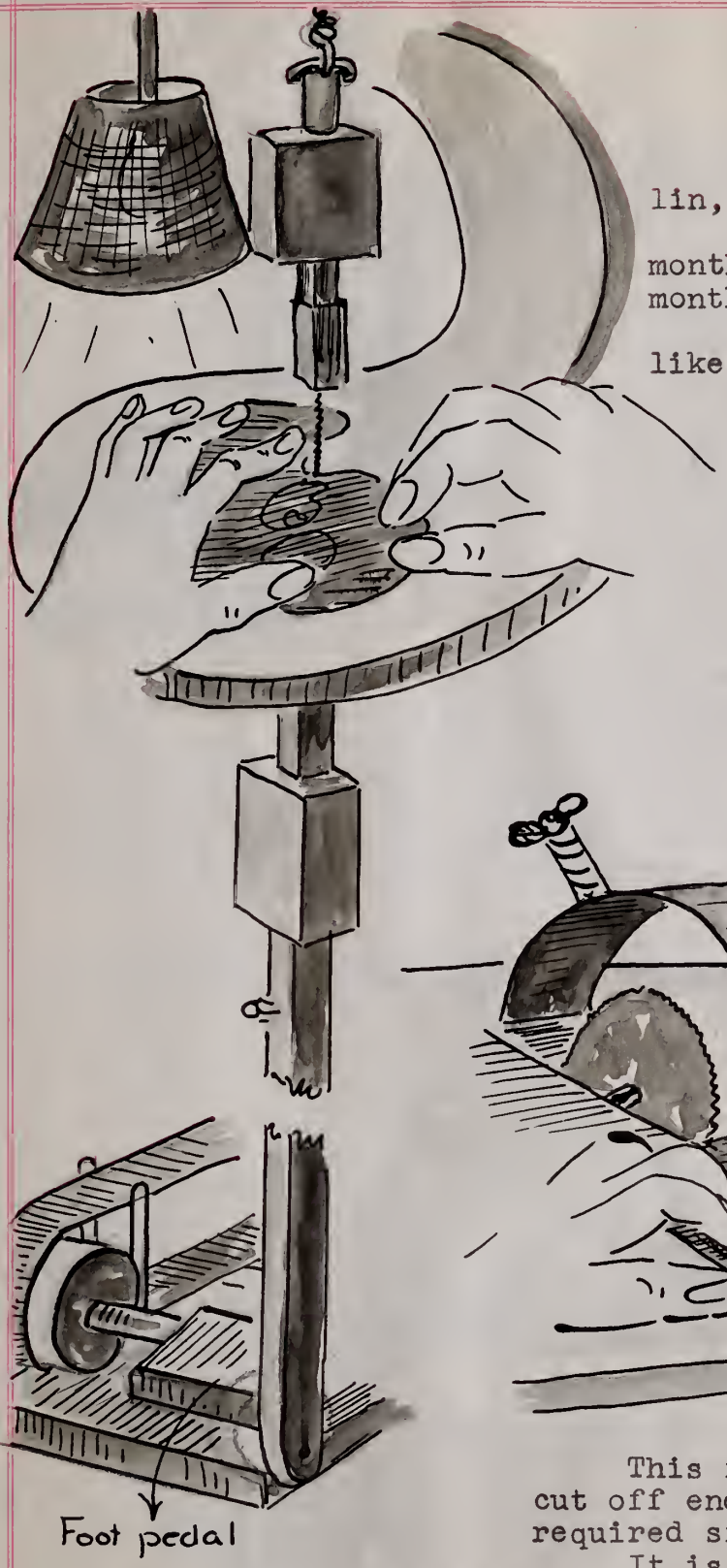
The water in the tanks is kept very hot. One tank has cold running water. The plastic stock is left in the hot water until pliable, then it is pulled out with pliers and shaped with the fingers.

Learning time: C 6-10 weeks. Five people employed in this department. The children will have some experience in this craft.

The young lady is twisting lucite to be shaped into a bracelet.

The rings for chains are made in this department if not molded. Buckles are twisted in this department.

Chain directions given on page 86.

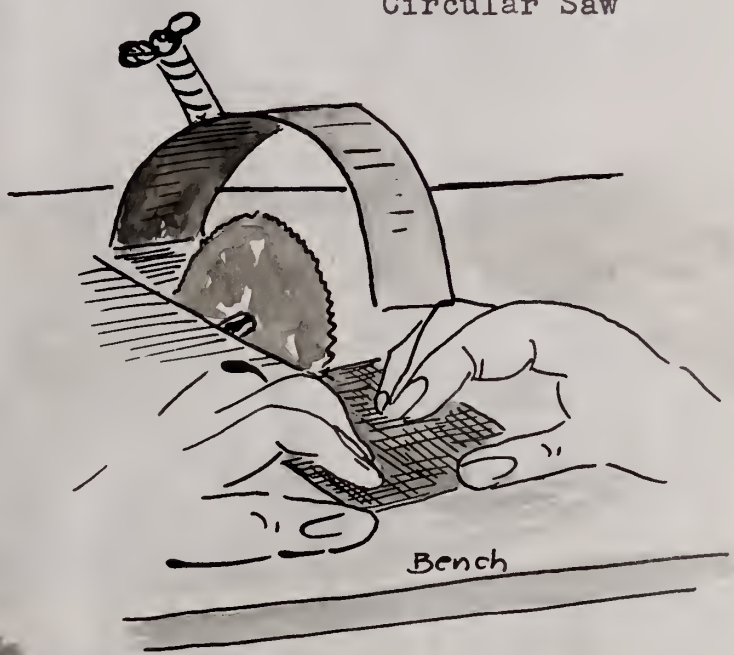


Jig sawing is used on catlin, plastic, and wood.

Time to learn: D—, 2-3 months; trade school, 2-3 months; N—, 2-6 months.

The machine is operated like a sewing machine and is controlled by the left foot which moves in a sideward motion away from the body. In normal times N— employs ten to twelve men.

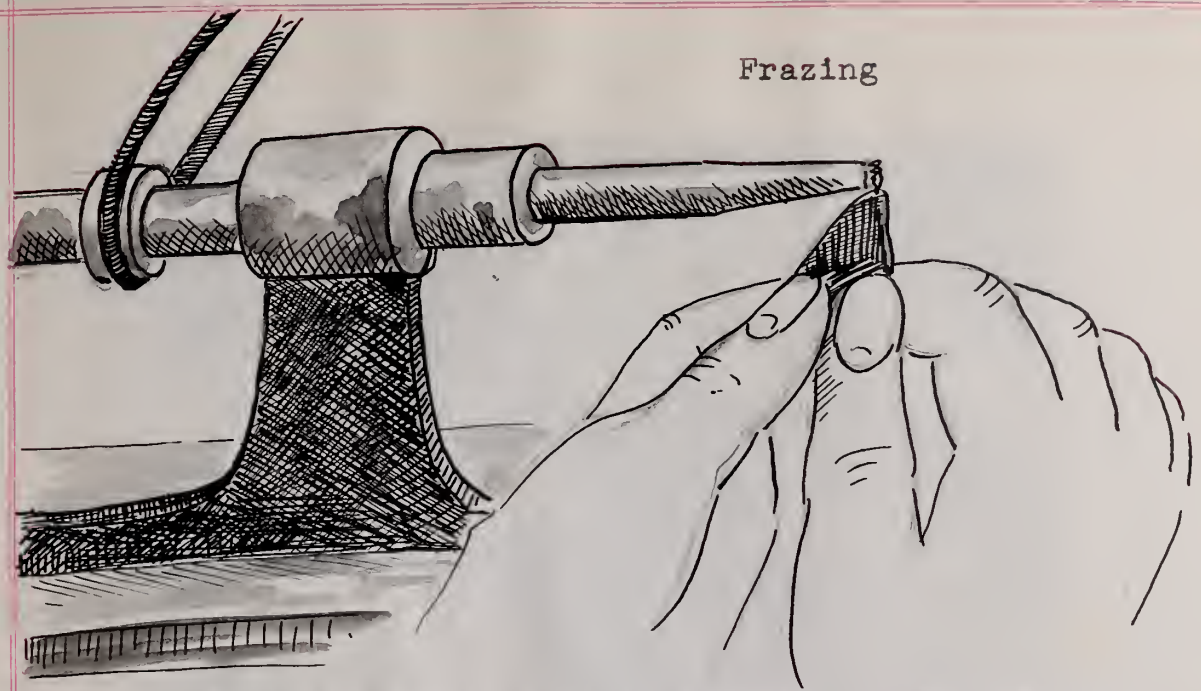
Circular Saw



This is used to split materials, cut off ends, get material to its required size.

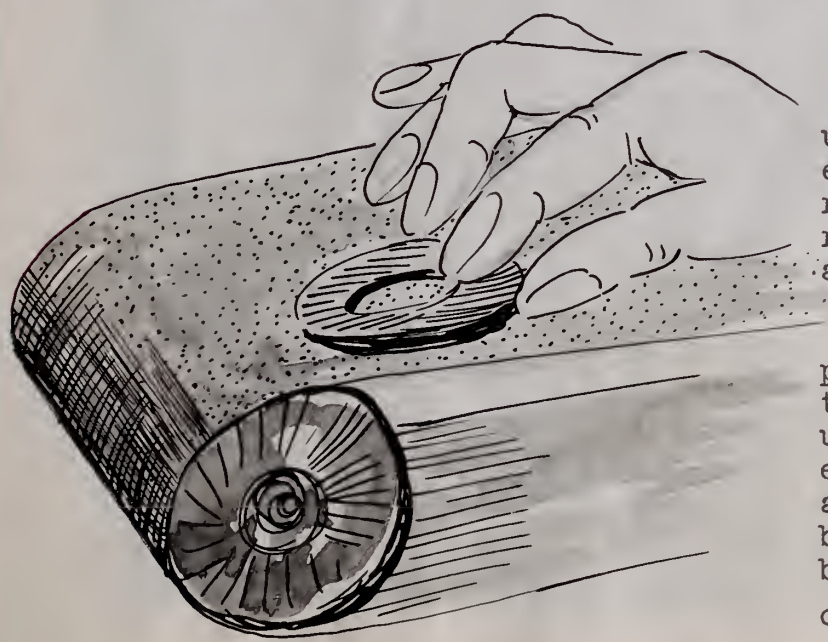
It is man's job and is very dangerous. Glasses or shields must be worn to protect the eyes and face from flying pieces.

Frazing



This type of work is very important in wood work and catalin products. A person with artistic ability will be a much better workman than one without. This is not absolutely necessary, but such a person can do much better work. Until the present war need, only men were allowed to operate these machines, for there is danger in being cut. Manual dexterity and mechanical aptitude are needed.

Learning time: D—, 4-5 weeks; trade school, 6-8 weeks; N—, 6-8 weeks. The number of men in the department is ten.



Sanding

This process is used to smooth materials. A sand paper revolves over two rollers. The operator holds the material, giving just enough pressure needed. If too much pressure is used, too much material is smoothed away. Operators must be careful not to burn their fingers on the moving sand paper. Both men and women do this work.

FRAZING

BURRING MACHINE

This machine is used to make the holes in the buttons.

Inspecting

One must have good eyesight and be very observing to work in this department. One must be alert, also. The belt revolves at a medium speed but one must be quick or the imperfect buttons will pass by.

As the belt moves before the inspector, the buttons are turned over with the hands. The imperfect ones are taken from the belt and put into a container. Only the perfect buttons stay on the belt where they are dropped into a container. This container is moved, when filled, by the floor boy.

The imperfect buttons,if they cannot be improved,are reground with the gate waste and made into powder for more buttons. None are wasted.

Inspecting is also done on the benches, without the machine that is pictured above. It is a slower method but one that is used in the factory.

SETTING UP THE EXPERIMENT

After the job analysis in the factory had been done, it was ascertained that all the children in the prevocational classes do not go to trade school. Some go to the junior high school while others remain in the prevocational classroom until they are old enough to go to work.

The author felt, seeing many do not go to trade school and many go directly from the classroom into the factories, that, if they could receive some training while in the classroom, they could enter industry with confidence, knowing the type of job they could handle and be happy in doing. Training given in the classroom would reach all the prevocational pupils, giving them some vocational training before they left school to work in the plastic plants.

Those who left the prevocational class to enter junior high would have had some training so that when they did leave school to work in the factory the work would be familiar to them.

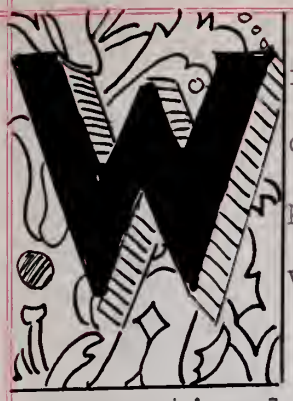
The ones who leave the classroom to go to the trade school would find the transition from the hand machines used in the classroom to the automatic and power machines much easier than if they had not had the previous training. The basic knowledge would help the trade school instructor for the children would have a foundation on which he could build skilled workmen.

he work would not be a repetition as the author was careful in planning the work with this in mind. There are some hand machines at the trade school, for it is a necessary part of training to learn the basic fundamentals first. The trade school projects are quite different from those planned by the author to be taught in the classroom; only the basic skills are the same, and, the more training that can be given in these, the finer the work.

Those who remain in the classroom until they are of age to work would have the same experience when they enter the factory as those who enter the trade school. Their training would help them to make easily the transition from the hand machines to the power machines for basically they are operated in the same manner, only, of course, at a rapid speed. After their preliminary training in the classroom, they would feel perfectly at ease after one week at these machines.

Thus the author felt the need of setting up such an experimental workshop in a prevocational classroom. This was done through the kindness of two co-owners of two local plastic companies. They loaned the machinery and generously gave all the materials to carry out the experiment.

To ascertain what could be done with a minimum of materials and only hand tools; such as, pliers, clippers, dowels, and a heater, another class was set up in one of the special classrooms.



ith this group the author hoped to show what could be done in a classroom where it was not possible to obtain machines and to ascertain the value of plastic work as a classroom project.

The author felt that much time is spent in prevocational and special classes on work that has neither interest nor value to the child. These children have so little that the author believed the least a teacher can do is to see that they are happy while in school and that their time is well spent. This thought urged her to carry out this experiment, knowing from her own experience what fun it is to work with lovely materials and to make things one can wear.

The two teachers chosen to carry out the experiment had had no previous training in plastic work. They were each given a set of directions as presented in this study and a copy of "Plastics in a Nutshell", written from selected readings compiled by the author to provide a background for the teachers. Most of the books written in plastics are so technical that the average teacher would be unfamiliar with the terminology used. Acetate plastic is so new that there is very little information on the subject. Much of the information within these pages is from the actual experience of the author. Acetate plastic is the chief material to be used in the classroom experiment. Conda perl, a form of plastic, and lucite will also be employed.

PLASTICS IN A NUTSHELL

You may wonder why this study was called "Plastics in a Nutshell". True, it will be a brief history of plastics, but that was not the only reason. The author thought it might be of interest to know that walnut shells are used as a filler in the finest of plastic materials. Many people have the idea that anything made from plastic material must necessarily be cheap. This is a false idea. Plastic, especially in jewelry, can be beautiful and as expensive as many of the choice pieces of gold jewelry that have been designed with care. Many strings like those the class will make have sold in the large department stores in New York and other cities from one dollar to five dollars each. All are from the drawings made by the author.

"Plastics are no longer a mystery," says Lougee, editor of the "Modern Plastic" magazine for five years, now chairman of the advisory board of the Plastic Industries Technical Institute, California. He continues, "They are too firmly entrenched as essential materials to industry to go otherwise than expand rapidly. There can be no doubt either about the opportunities offered in this rapid growing field."[1]

In "Building America" it says, "Everyone knows about "plastics", one of the most common products used today. After the war it will be even more widely used. It has been suggested

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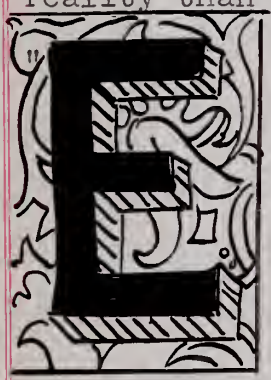
1 E.F. Lougee, "Your Career in Plastics", reprint from The Boys' Place in Life, p. 14.

that this fast growing industry may supply an important source for jobs for unemployed workers."[2]

...."Artists, craftsmen, and manufacturers have always dreamed of an imaginery 'Ideal Material' that was near at hand, abundant and inexpensive, that had all the advantages they looked for and no disadvantages. The modern chemist working in the field of 'plastics' has been bringing this dream closer to reality than anyone could have foreseen a century ago."[3]



arly in 1943 it was estimated that the years production of plastic goods would reach about half a billion dollars. Yet this important industry is less than a century old and only started in a modest way; as one writer says, 'it may be said to have sprung from a ball of cotton and bits of wood'. How did we come to have plastics? African natives really started the plastic age by killing too many elephants, for as elephants went down, the price of billiard balls went up."[4]

In 1850 John Hyatt, a small printer, decided to try and earn the ten thousand dollar reward offered by a billiard concern to anyone who could discover a substitute for ivory. In 1869 he founded the first synthetic plastic. It was made from cotton linters, wood pulp, nitric acid, and camphor. He

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2 "Plastics", Building America, viii, No. 7. (April, 1943), p. 223.
3 Ibid., p. 197
4 Ibid., p. 210

called it celluloid. Its chief ingredient was cellulose found in plant life.[5]

"Even though it was not suitable for some purposes it was the only synthetic plastic in the market anywhere until 1900 and the only one produced in the United States up to about 1910....Even before Hyatt discovered celluloid, however, European chemists had produced a non-inflammable plastic in their laboratories from cellulose and vinegary acids (cellulose acetate) and artificial silk was made from it. This was introduced in America in 1912 although cellulose acetate compound was not made in this country until 1927....Jewelers sold articles made from celluloid, substituting the scarcer high priced goods."[6]

Breskin says that the corner of the vast plastic industry was not laid until forty years later after Hyatt discovered celluloid. "Doctor Baekeland, working in a tiny laboratory in Yonkers, New York, discovered a substitute known as 'bakelite', named after him."[7]

Doctor Baekeland was a Belgian chemist who had lived in the United States for a number of years. He was experimenting to find a substitute for shellac. In 1909 he was given a patent for this "bakelite" discovery. Celluloid was a "thermoplastic"; that is, it could be softened by heating and hardened

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5 "Plastics", op. cit., p. 210.
6 Ibid., p. 211.
7 Charles Breskin, "Plastics in the Future", Vogue (February 1, 1943), p. 123.

by cooling again and again. Bakelite was a "thermosetting" plastic, which means when once the material is set by heat and pressure it cannot be resoftened and reshaped.[8]

As Breskin says, "Since then the development of plastic has been nothing short of phenomenal."[9]

It might be of interest to mention that the metal buttons of the servicemen's uniforms are now being made from plastic. Breskin says, "This represents a saving of sixty thousand pounds of brass."[10]

BuBois asks, "What does plastic mean? According to the dictionary 'plastic' comes from the Greek 'plassein', which means to mold, capable of being formed or molded as clay. The art of casting pieces is very old....first used five thousand years ago. The important materials of today, however, began to take form with the initial production of celluloid in 1870."[11]

DuBois says, in essence, when Baekeland announced his phenol-formaldehyde resins in 1909, he gave to the world "the magic material which has shaped the course of many industries and paved the way for the large growth which the plastic industry has since discovered."[12]

The thermosetting plastics, known under the trade names of Bakelite, Durez, Resinox, and many more, and, in the casting field, catalin, as mentioned earlier, cannot be reshaped once

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8 "Plastics", op. cit., p. 212.
9 Charles Breskin, op. cit., p. 123.
10 Ibid., p. 123.
11 J.W. DuBois, Plastics, p. 2.
12 J.W. DuBois, op. cit., p. 2.

they have been set. The scrap of these materials cannot be reused as can the scrap of the thermoplastics. The scrap of the thermosetting plastics can be used only as a filler. The catalin has been widely used by home craftsmen and by teachers in their classrooms. The trade school uses catalin a great deal. If you are interested in reading about catalin projects, look up the books Plastics Problems and Processes by Dale E. Mansperger and Carlson W. Pepper, published by the International Textbook Company, Scranton, Pennsylvania, and Plastics in the School and Workshop by A.J. Lockery, published by the Van Nostrand Company in New York.

n the booklet Plastics In Industry, this statement is made:"Chemically cellulose acetate has been known almost as long as celluloid (the oldest of the plastics, 1864) but not used for manufacturing until 1914 and not until 1924 was it put out in sheets and later moulding powders. It is non-inflamable and perfectly safe."[13]

The author feels that the preceding statement is not absolutely correct for from actual experience she has seen acetate burn. True, it is not as dangerous as the celluloid because it does not blaze like the celluloid. Usually it melts into a gooy mess but if put into a direct flame it will burn. Celluloid is dangerous because it not only blazes but it explodes. It is rarely used in manufacturing now. The

13 Plastes, Plastics In Industry, p. 7.

factories in this community have discarded it entirely. By law it cannot be used for novelties, hair ornaments, jewelry, or toys. The author thinks there are many more such restrictions, but these she knows to be true from her own field of experience.

The Plastic Catalogue states, "It was not until the outbreak of World War number one that any substantial commercial progess was made in plastics ....plastics appeared commercially in this country in 1927."[14]

"Mechanical strength and toughness are outstanding characteristics of acetate plastic. Rugged and durable articles can be molded if formed with relatively thin cross sections....unlimitable color possibilities are the invaluable tools of the artist and designer. Cellulose acetate plastics may be obtained in transparent, translucent, and opaque color in all shades of the spectrum."[15]

DuBois says, "Cellulose acetate is one of the relatively new materials which has experienced the most phenomenal growth in recent years....The real use of cellulose acetate from the introduction of injection molding machines in 1934 came fifty-seven years after the pioneering of celluloid."[16]

He also says in essence that the thermoplastics can be

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14 Plastic Catalogue, 1943, p. 110.
15 Ibid., p. 112.
16 J.H. DuBois, op. cit., pp. 71-72.

better understood when one considers it like sealing wax for it does seem like it. Anyone who has done any work with sealing wax knows that it becomes so pliable when it has been heated that one can easily mold it within one's fingers. When it is cooled, it retains the newly molded shape. The acetate will be just as pliable when heated and will retain the shape you have formed when they are cooled. In the factory when the acetate flower parts have been swedged (shaped by machine) the parts are tossed into pails of cold water to hasten the cooling process.

t is well to mention at this point that the acetone, one of the ingredients in the making of the acetate parts, is the liquid that is used to cement the acetate forms together. It really is a solvent that welds the parts together. One must be careful not to drop any of the liquid on any rayon fabric for rayon is a form of acetate plastic and the fabric will melt, leaving a hole.

Acetone will not harm the hands: its only effect will be a drying one, no more harmful to the outside of the body than water. Neither will it harm cotton or woolen materials.

DuBois also says, "Acetate material is very machineable and is frequently used for the models of plastic parts because of its excellent machinability. It can be embossed, punched, engraved, swedged, sawed, stamped, drilled, tapped,

cemented, and polished very easily."[17]

s polystyrene is to be used in the classroom experiment the author would like to quote the Plastic Catalogue as saying, "In the United States polystyrene is relatively new. Its acceptance by the injection molding trade in the past years has been outstanding....in 1933 America became interested, but not until 1937 did it come to any high availability that could be compared favorably with other plastics."[18]

DuBois says, "Styrene plastics or styrol resins was first produced in England in 1839 more than one hundred years before it was produced commerially in the United States. The cost retarded the development of this material."[19]

DuBois continues, "Polstyrene materials are prepared in all the transparent and opaque colors. The crystal clear and tinted materials are particularly attractive."[20]

Jewels are made from the polystyrene. The necklace made from the crystal clear flower parts is made from the polystyene material. You cannot shape this; it has to be used as it was molded. The stones must be put into a spider that has to be riveted to the part you wish to use in making the pins and the necklaces because the stones will not stay in place with cementing.

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17 J.H. DuBois, op. cit., p. 78.
18 Plastic Catalogue, op. cit., p. 165.
19 J.H. DuBois, op. cit., p. 106.
20 J.H. op. cit., p. 108.

ucite is one of the important plastic materials used in the war. The shatterproof glass used on automobile windshields is made from glass and lucite. This is made by pouring the liquid lucite between two pieces of glass, welding the two glass pieces into one piece of glass. The making of this glass comprises one of the chief products made in one of the local factories. Some of the pins the class will make are made from lucite material. This is a thermosetting type plastic.

An article found in "Building America" states, "Lucite has crystal clarity and remarkable optical properties. It appeared in America in 1935. It is clearer than glass, strange property of transmitting light through a curved surface."[21]

Du Bois says, "Doctor Otto Rohm did the original research work in the acrylic resins in Germany in 1901." Lucite is the trade name. "It was first manufactured in this country in 1931 for binding safety glass. Sheet materials were next offered in 1936 and they were followed by molding powder in 1937 and this material was called lucite."[22]

Chemists are constantly working to perfect the lucite material so it can be handled like the thermosetting. Then there will be no waste; just now it is like the thermosetting type.

Lougee writes, "There is one nice thing about having a

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21 Plastics. op. cit., p. 13.
22 J.H. DuBois, op. cit., p. 85.

working knowledge of plastics; that is, you can apply this knowledge in almost any field you would like to enter, you don't have to confine yourself to the plastic industry. Manufacturers of automobiles, aircraft, radio, electrical appliances, furniture, and dozens of other products use plastics in one way or another, and require the advice and services of men who know plastic materials."[23]

e continues to say, "As the years roll on new materials will be developed, new processes created, new machinery will be invented....Plastics are essential to industry....There are big opportunities in this rapidly growing field."[24]

It has been mentioned that the servicemen's uniform buttons are being made of plastic material. The tremendous advancement of plastics as a substitute for metal is shown also in a recent announcement in one of the newspapers that the army is using plastic bullets in target practice. Initially they cost a great deal less then actual bullets, and as they are shot by compressed air they can be used over and over again.

Simonds declares, "The National Farm Chemurgic Council has placed the gross annual business of the plastics industry in this country at more than two million dollars and other authorities have predicted that the business of plastics is

23 E.F. Lougee, op.cit., p. 14.
24 Ibid., p. 14.

destined to become one of the nation's greatest industries."[25]

ontinuing, he says, "Barnard Baruch in testifying before a special Senate committee called attention to the significance of new industries as a means for setting technological unemployment. The plastic industry is not only new but it is of a base character well designed to mother innumerable offspring industries."[26]

He continues to say, "Plastics have taken the craft world by storm. No material ever before offered has the beauty and artistic possibilities combined with the easy work ability with common equipment that is found in the cast plastics and in no other material can a perfectly finished professional looking project be turned out with such limited equipment, minimum labor, and comparative inexperience."[27]

Plastic work can become so fascinating that you and your class will have fun in making the pretty things and you will be rendering a service of worth to the children as well. Even those who do not go into the plastic factories will benefit, for the muscular dexterity which will come from the constant handling and making of the plastic pieces of jewelry will be of benefit to the student in any work he may do. As Simonds said,"The work when finished is so professional," the children will be thrilled. Of this, the author is certain.

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25 Herbert R. Simonds, Industrial Plastics, p. 14.
26 Ibid., p. 15.
27 Herbert R. Simonds, op. cit., p. 135.

THE SCHOOL GROUPS

In the prevocational group there are twelve boys and five girls with I.Q.'s ranging from sixty-six to ninety-seven. Their chronological ages are twelve to fourteen years; mental ages range from nine to twelve. The two boys with the I.Q.'s of ninety-seven ordinarily would not be in this class, but they are large boys and very slow. Owing to this, they were socially maladjusted and had become discipline cases. It was found, when they had been tried in this class, that they were contented and happy and wished to remain here.

All the I.Q.'s are from individual tests given by a state psychologist or the grade supervisor. The group rating is from a scale by Terman.[1]

Table V The Prevocational Group and Their I.Q. Record

12 Boys			5 Girls			Group Type	Remarks
C.A.	M.A.	I.Q.	C.A.	M.A.	I.Q.		
13-0	12-7	97					
12-0	11-8	97					
13-5	11-8	90				Dull	
11-2	10-1	90	12-10	11-1	86	Normal	
12-6	10-1	81	12-8	10-6	83		
12-7	10-8	81					
14-1	11-3	80				Dull	Serious Hearing Disability
12-0	9-7	80	.....	.....	.....	.....	
13-8	10-8	78					
13-5	10-4	77				Borderline Deficiency	
13-7	10-2	75					
			13-5	10-1	75		
			13-3	9-8	73		
			12-7	9-2	73		
13-6	9-2	68				Moron	
14-9	9-2	66					

1 Lewis M. Terman, Measurement of Intelligence, p. 78.

In the special class group there are twelve boys and four girls. All fall into the inferior group as given by Terman. He says, "The majority of cases falling below seventy may be considered feeble-minded."[2]

Table VI The Special Class Group

12 Boys			4 Girls			Group Rating
C.A.	M.A.	I.Q.	C.A.	M.A.	I.Q.	
12	9-3	77				
12-	9-3	77				
			11-	8-4	76	Borderline Deficiency
11-	8-3	75				
10-	8	73				
13-	9-4	72	12-	8-6	72	
12-	8	70	12-	8-4	70	
12-	8-3	69				
13-	8-6	66				
12-	7-9	66				
13-	8-5	65				Moron (Feeble-minded)
11-	9-2	64				
13-	8-2	63				
			13-	7-1	55	

THE EXPERIMENT

The experiment was planned to ascertain whether industrial training could be successfully taught in a prevocational class. Only the basic skills are to be taught for the experiment. The author, having the knowledge of seven years of experience in plastic training at the trade school, felt that she did not need to prolong the experiment over a period of time necessary to produce proficient and skilled workers. Once the basic skills have been taught thoroughly, only time is needed to make the pupils into skilled workers. Only practice can accomplish this.

2 Lewis M. Terman, The Intelligence of School Children, p.121.

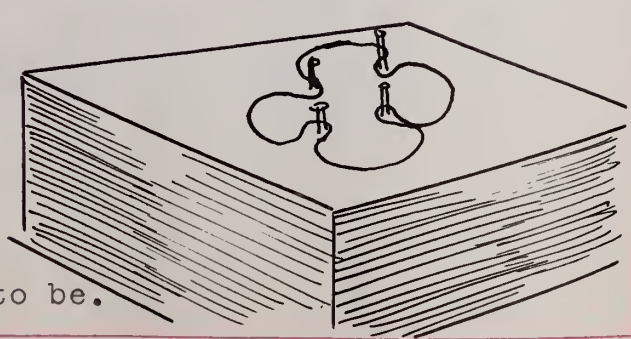
The experiment will only require each child to learn the basic processes in assembling, which will include the making of chains, commercial stringing, hand painting, cementing,and drilling. As a riveting machine was not available, this process will not be taught. All the riveting needed was done in the factory by a girl who had spent three years in this same classroom. The class will be taught shaping flower parts with their fingers, with pliers, with hand dies, and with the hand swedging machine. They will learn the process of blanking, which is also called polking. Experience will be given in the hot water work, making links for chains, and twisting bracelets and buckles. Degating of buttons will be taught as it is done in the factory with the fingers using the board method (page). The method of setting stones will be taught. The girls in the factory who set the stones do not necessarily rivet the spiders in which the stones are set. Since riveting is done in another part of the department, the stone setting in class will be done under factory conditions, the riveting having been done as mentioned previously. Every child in the prevocational class will make a duplicate copy of all the pins and the necklaces with bracelets to match, as illustrated in the directions. The special class cannot do this as there is not enough material because of the present war conditions, but they have enough material to learn all the processes that can be done without machinery. The teacher will

apply the given directions to the material she has on hand.

Each piece has been planned to teach a new process and each one grows out of the preceding piece. They are arranged in this order. Each piece will be matched just as it is matched in the factory. When all the pieces have been made, the class will spend the rest of the school year designing their own jewelry, applying the learned basic skills.

Limiting the machinery to the three machines illustrated made the project as inexpensive as possible for an ideal workshop. Both the polking and swedging can be taught on the same machine by changing the cutters used in polking to the dies needed to swedge or shape the parts. The machine used here was bought secondhand for fifteen dollars. It cost five dollars to repair it for the class. A new machine would cost twenty-five dollars.

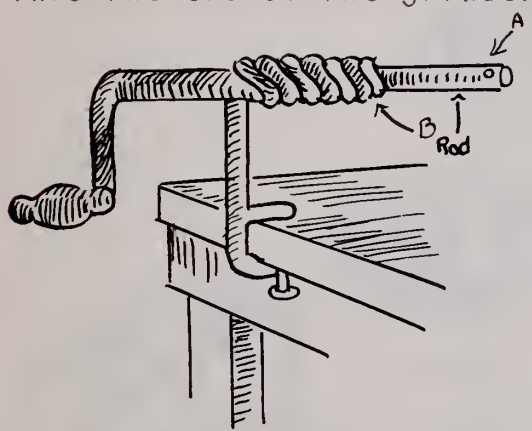
A drilling machine like the one used in the classroom would cost twenty-five dollars. This machine is not necessary to teach drilling; a hand drill may be used. The special class will use the hand drill method. When drilling with a hand drill one must drive nails around the outside of the piece to be drilled onto a block of wood to hold the piece firm. This is necessary so the intended hole will come where it is planned to be.



The machine would be necessary to a class being trained vocationally. This is the regular drill used in the factory.

The other illustrated machine is used in the hot-water department to make links for chains and buckles. This machine costs twenty-five dollars.

This process could be taught without the machine. The teacher could adapt an old meat grinder. A round rod must be driven into the end of the grinder at B. A hole must be drilled at the end of the rod at A, the size of the stock to be used. To change the sizes of the links use different sizes of rods. A pencil sharpner could be adapted the same as the meat grinder. Pencils may be used to make small links for a dainty chain. Complete directions will be found on page 86.

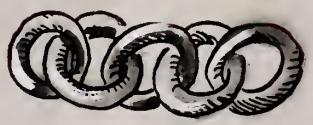


Materials needed for this experiment are; strip stock, beads, plastic rods, molded findings, pin-wires, metal rings, pins on plastic bases, acetone for cementing and painting. A heavier cement needed for the conda-perl and lucite material. A heater with an asbestos mat, hand clippers, pliers, a chopper, and various sized rods are needed to shape the flower and leaf parts.

DIRECTIONS

To make a plain chain, take the molded rings and interlock them. Cement the openings in the links with acetone. The acetone is painted on with a brush. Care must be taken not to allow the acetone to run over, as it will take the luster and color.

Round rings, oval rings, flat rings, and conda perl are used.



Single and Double

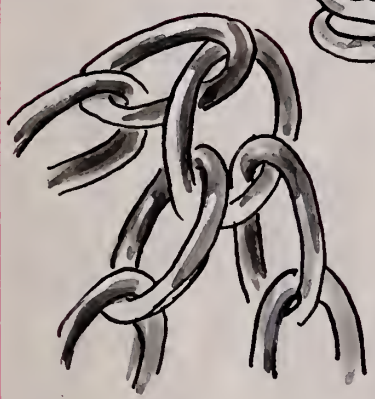
A single link and two links.

Double Chain

Two links locked in the next two links.

Triple Chain

Three links locked in three links.



Conda Perl Chain

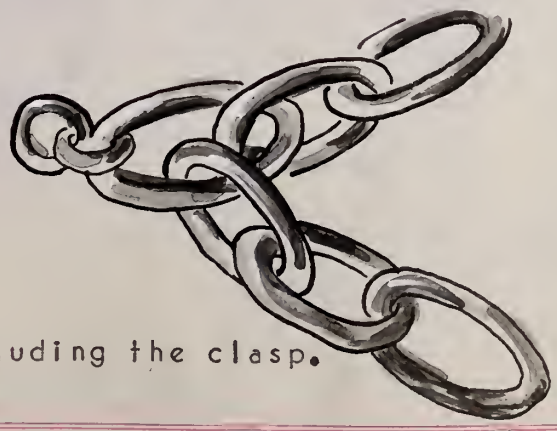
Make single links for back neck (10 in.)
Then make a double single chain for front.
Outside chain...21 in.
Inside chain....19 in.
Catch both chains into one loop; then continue 10 inches of single chain. Join with loop one. No clasp is needed.

For bracelets to go with the Conda Perl Chain, the same combinations may be made with other links (the acetate rings).

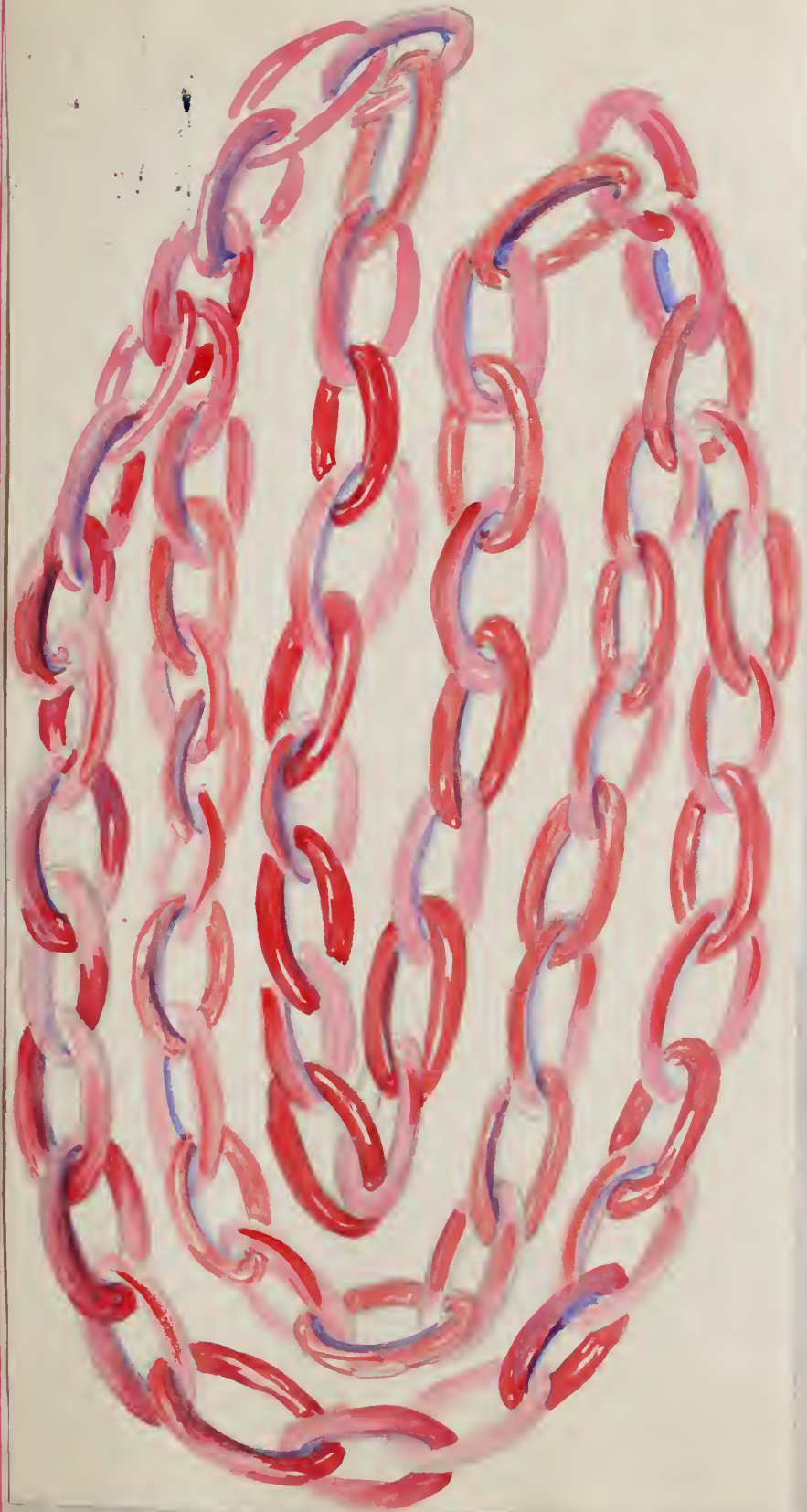
Single Chain

Two Strand

Three Strand

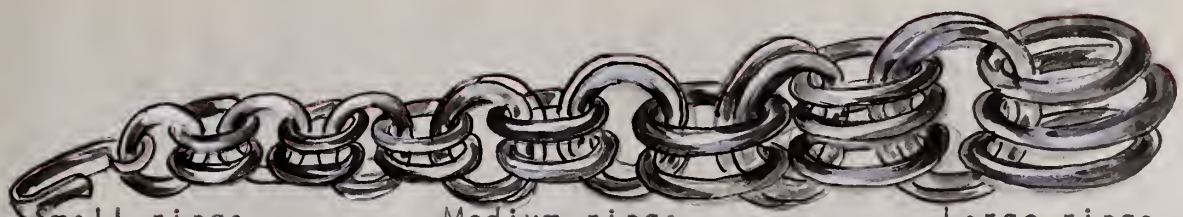


Bracelet, usually $8\frac{1}{2}$ inches including the clasp.



Bracelet

Combination of chains with one, two and three links.

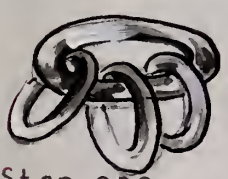


Small rings	Medium rings	Large rings
Three groups	Three in a group	Three in two
Two in one link	Two links in two links	Links

(Bracelet). Begin with small single rings, then a double and a single. Use three in a group, the same for three groups, then the third size of rings, using the two and three combination for two groups; then three and three, three times. Then reverse for the other side of the bracelet.

To make the chain, just lengthen the group combinations, making the chain as long as you want it. Both the chain and the bracelet can be made singly or in two layers of assembled chains.

Bracelet and Chain with Hanging Rings

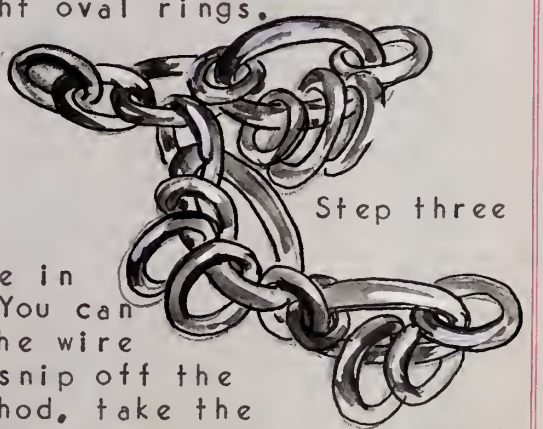


Step one

Step one: Place two medium round rings and a larger ring within the oval ring.

Step three: Between the single rings add ten flat oval rings for the outside of the chain. To the beginning round ring, add another oval ring for the inside chain. This time use eight oval rings.

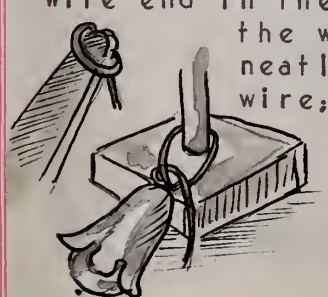
Step two: Step one shows how to add the hanging rings. Two shows the back of chain. Add the clasp to this part of the chain.

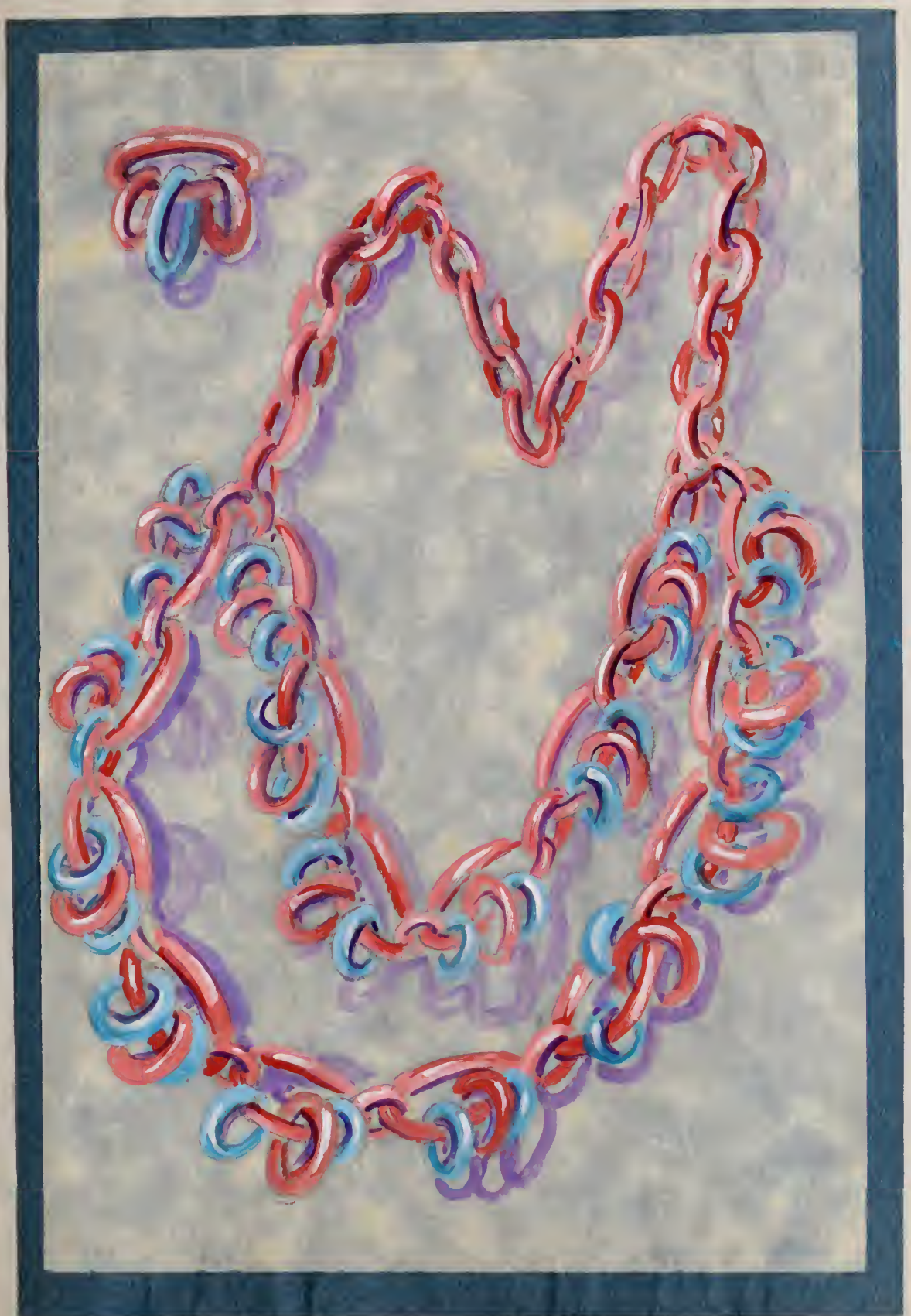


Step three

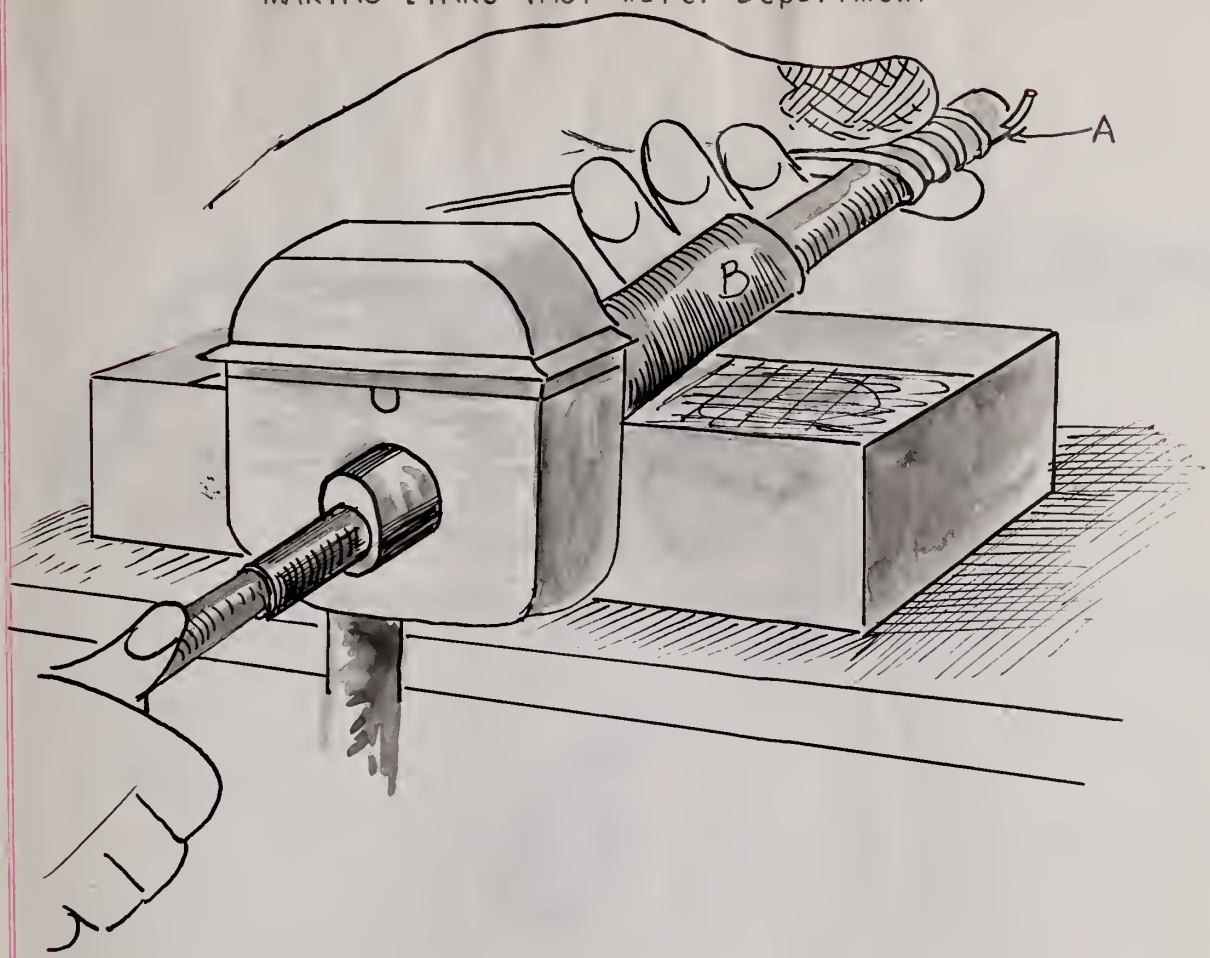
To Loop The Pin Wires

Take wire heads put through the hole in a bead. Then wire through the bell. You can bend the wire two ways; one, loop the wire around the end of the pliers, then snip off the extra length. Two, for the nail method, take the wire end in the pliers, twist it around the nail, then around the wire at the end of the bell. Now cut excess wire neatly. You may twist the bell if you like or the wire; both are correct ways to do this. Twist twice. Try both methods as both are used in the factory. The end of the pliers will make a large enough loop. "A"





MAKING LINKS (Hot Water Department)



To make links you need a pan of very hot water. Let the rods remain soaking in the water until they are softened. Do not put your hand into the water; use pliers, a fork, or a piece of wood. You will see a little hole at A. Put the end of the rod in here. Now wind by turning the handle with your right hand. Hold the rod with the left, as pictured above. When wound, slip off. You will have a spring. Each link is cut with the knife blade that is fixed into the wooden handle. It looks like a meat chopper. Be careful of your fingers. The knife is very sharp. If you want a larger, or smaller link, use other bars. The bars fit into the machine at B. They lock into place.

When you have made your chain, cement the rings as you did with the molded links.

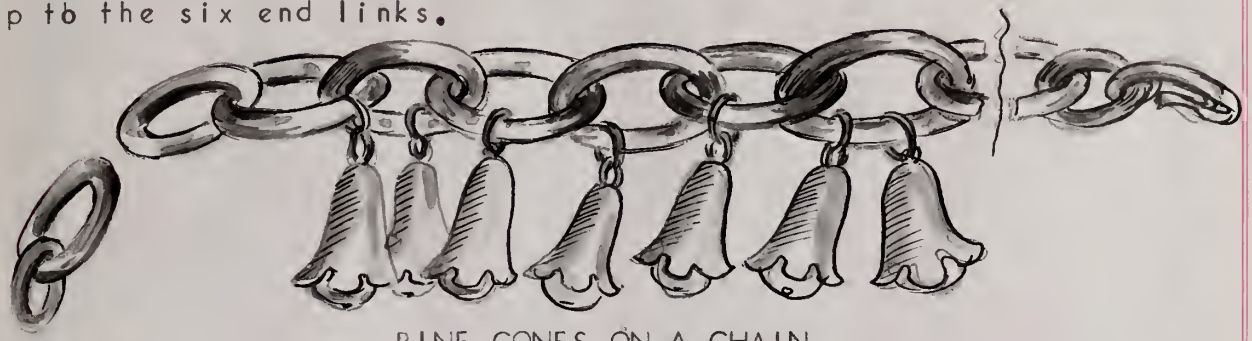
If you would like to make a twisted bracelet, use a rolling pin and twist stock around this with your hands.

You have been assembling chains, using molded links. Now make some on this machine and assemble these.

BELLS ON AN OVAL CHAIN

Assemble eighteen or twenty inches of single flat oval links. Metal rings will also be used. Be careful to close these metal rings with the pliers. The ends must not overlap.

If you are making the eighteen inch chain, count six links, then attach a bell. Repeat in each link until you reach the center link, add two bells in this link, then continue one in each link up to the six end links.



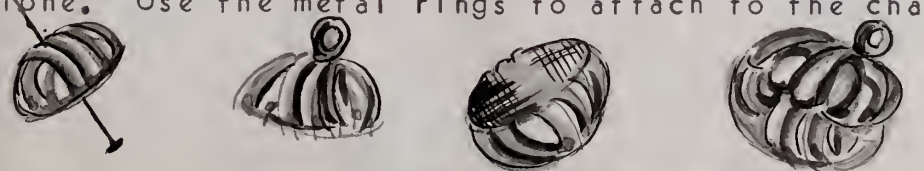
PINE CONES ON A CHAIN

Each cone must have a loop. Use head pins, just as you did for the bells. Nineteen cones and nineteen metal rings are needed. Measure seven inches of chain. Put a metal ring through the loop on the cone and attach to the chain. Be sure to close the ring carefully. The ends of the metal ring must meet, not overlap. WARNING:

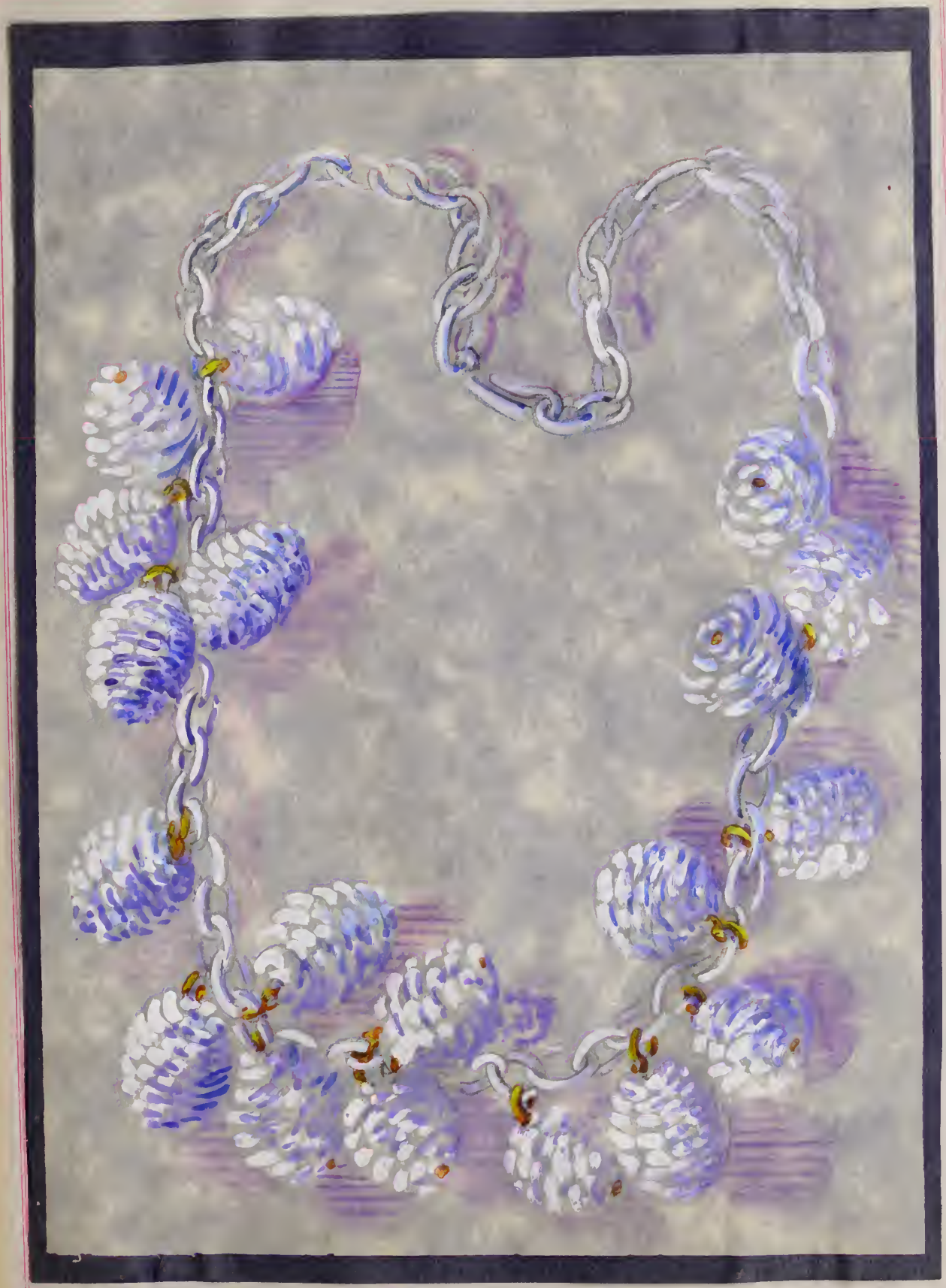
These cones are made from celluloid, so keep away from a direct flame. This is the only celluloid that will be used. The other material is acetate and is not flamable unless burned in a direct flame. Acetate is like sealing wax and will melt with intense heat, but there is no danger to the person using it.

BALLS OF WOOL ON A CHAIN

The balls have been made for assembling. These were used as ball buttons; that is why the rings are in the balls. If you did have to make the balls, this is what you would do. Drill a small hole in the upper half of the ball. Put in a head pin, loop as you have done before. Then cement the two halves together with acetone. Use the metal rings to attach to the chain.



Beads may be used instead of ring chain if desired.



STRINGING

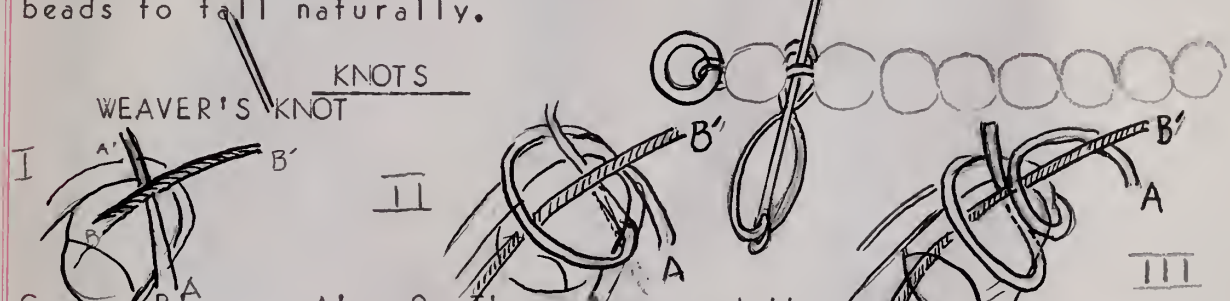
Have the knot about one inch away from the end so as to make a neat beginning. The end threads will go through the beads and

not show. Pull the loop through the ring; put the needle through this loop. Then string the beginning bead.

At the end of the beaded string do the same. Put the loop through the ring, as you did at the beginning. Run the needle back through the last bead. Knot. Do this by looping between the beads. Repeat in at least three beads. Then cut the thread. Do not pull the thread, when stringing, too tight. Allow the beads to fall naturally.

KNOTS

WEAVER'S KNOT



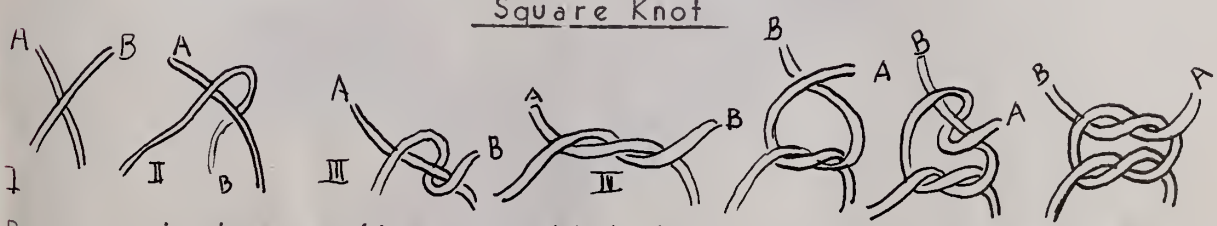
Cross B' over A' between the thumb and the finger.

2. Throw A around the thumb and finger.

3. Then bring the thread A between the thumb and the finger and between the threads A' B'.

4. Now bend the thread B' over the threads between the thumb and finger. Pull thread A. Hold the other threads between the finger and thumb firmly and ease the knot into place as you pull the thread A.

Square Knot

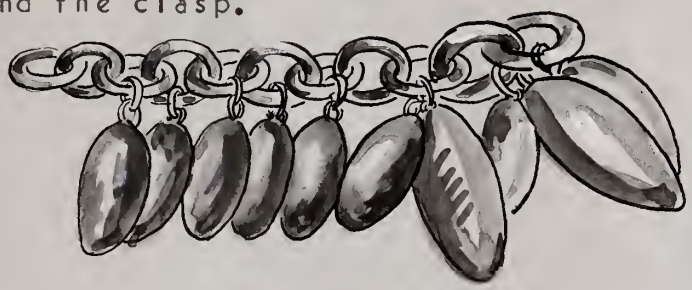


Be sure to have a figure eight before you pull the end threads if not you will have a grannie knot not a square knot. The grannie knot will slip, does not hold like the square knot.

When threading the needle for a chain measure double thread allowing about four or five inches more than you need for the chain length. Thread the needle singly. tie the ends of the thread with either a square knot or the weavers knot. Both are used in the factory.

OVAL BEADS ON A CHAIN

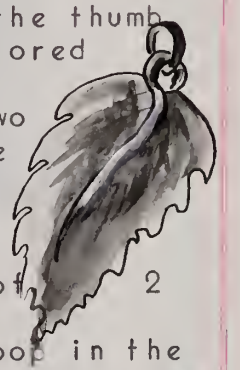
These beads have been molded with the metal loop ready for stringing. Make the chain six inches long. Then five more rings. In these five rings attach a dull bead in each one. Now combine a small bead and a larger transparent bead with a metal ring, making a cluster in a ring. Combine seven clusters, then continue the chain with the five single dull beads. Now the six inches of chain and the clasp.



LEAVES ON A CHAIN

Step One: To shape the leaves, heat each leaf until it is pliable; then twist the leaf between the finger and the thumb. Use any color combination you wish. The multi-colored combination is very attractive.

1

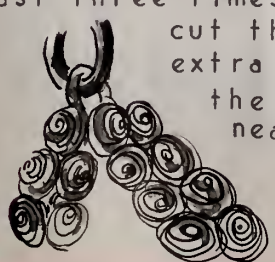

2

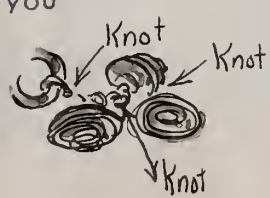
The leaves may be attached two ways. One method is to attach the leaves to the chain using the links of the chain. Only the chain needed for the back of the necklace is assembled. The rest of the chain is assembled as the leaves are attached. Each link is put through the loop in the leaf then attached to the next link in the chain. All the links must be cemented carefully with acetone when the chain has been assembled.

Second Way: The method used this time is to attach each leaf with a metal ring to the assembled chain. (2).

The Corn Kernel Chain

Assemble the chain length for the back of the necklace. The kernals are attached by stringing. Two lengths are needed. One for the inside, this is shorter, a longer one for the outside. The kernals are strung alternatingly, one on each side. String just as you did when you strung beads. Be sure to knot at least three times between the end kernels before you cut the thread. Allow six inches of extra thread when you begin to string the kernals. Neat beginning and a neat ending.





ROSE BUD CHAIN

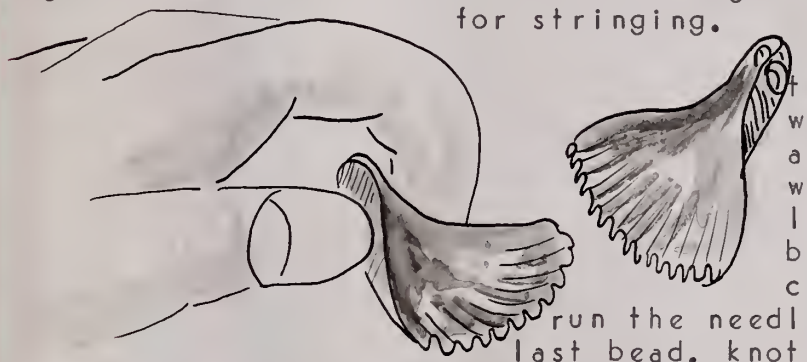
Try to find a molded ring without a slit. If you must use a slit one cement it with acetone, firmly, so the thread will not slip through. Now string the beads. Sixteen beads are needed for the back of the chain. Alternate, a rose, a leaf, a rose, etc. for eight and one-half inches; then string sixteen beads, and the clasp.

BLUE BELL CHAIN

Make wire loops in each bell as you did before. Do this in twenty bells. String beads for the back; then put a bell after each bead. In the center hang four bells to a metal ring; then add one as you did on the other side of the chain. Complete.

SEA SHELLS

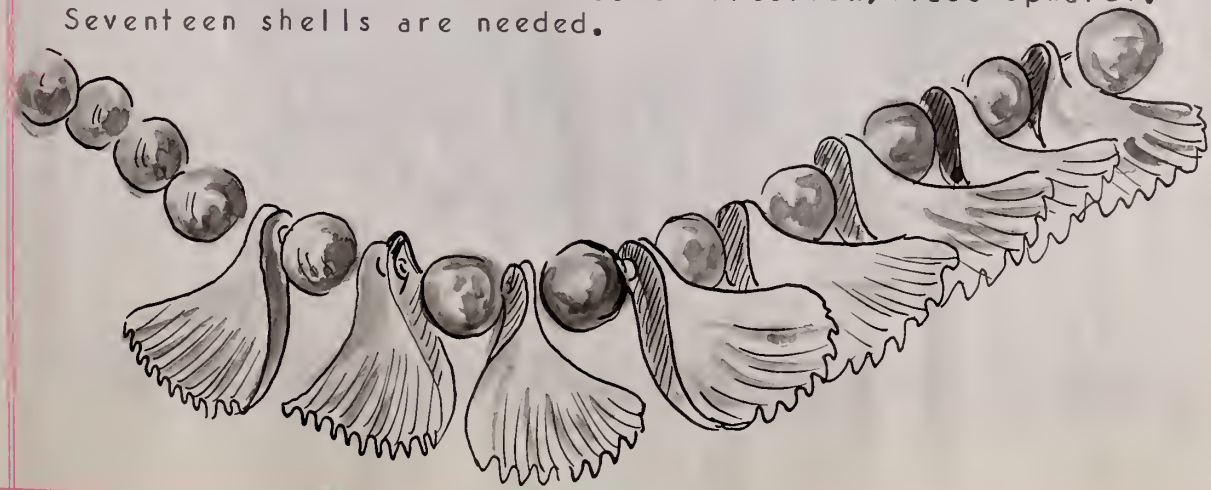
Heat the shells, pinch the small end together with the fingers. Now drill a small hole through this pinched end; ready for stringing.



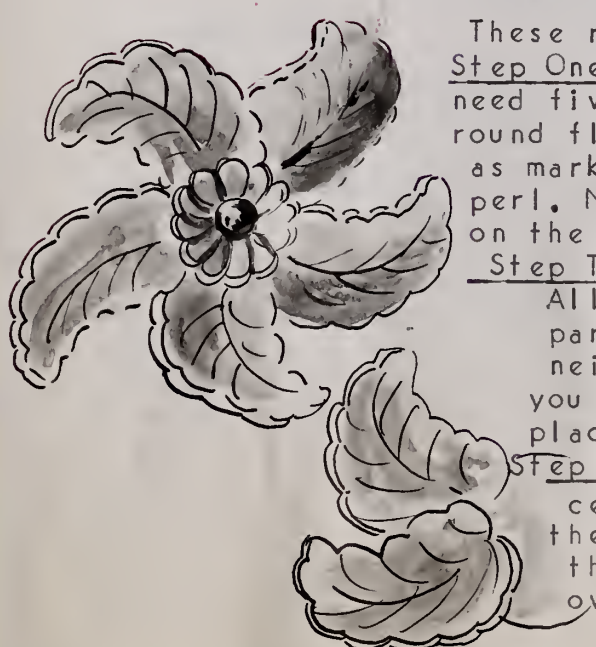
String the beads for the back, length you wish. Then add a shell, a bead, as many as you wish. Complete the necklace by repeating the beginning. When the clasp has been added, run the needle and thread through the last bead, knot, repeat three times, as taught. Then cut the thread neatly.

The Sample Necklace

String seventeen beads, then a sea shell, a bead between. Be sure the shells fall in the same direction, (face upward). Seventeen shells are needed.



CONDA PERL PINS

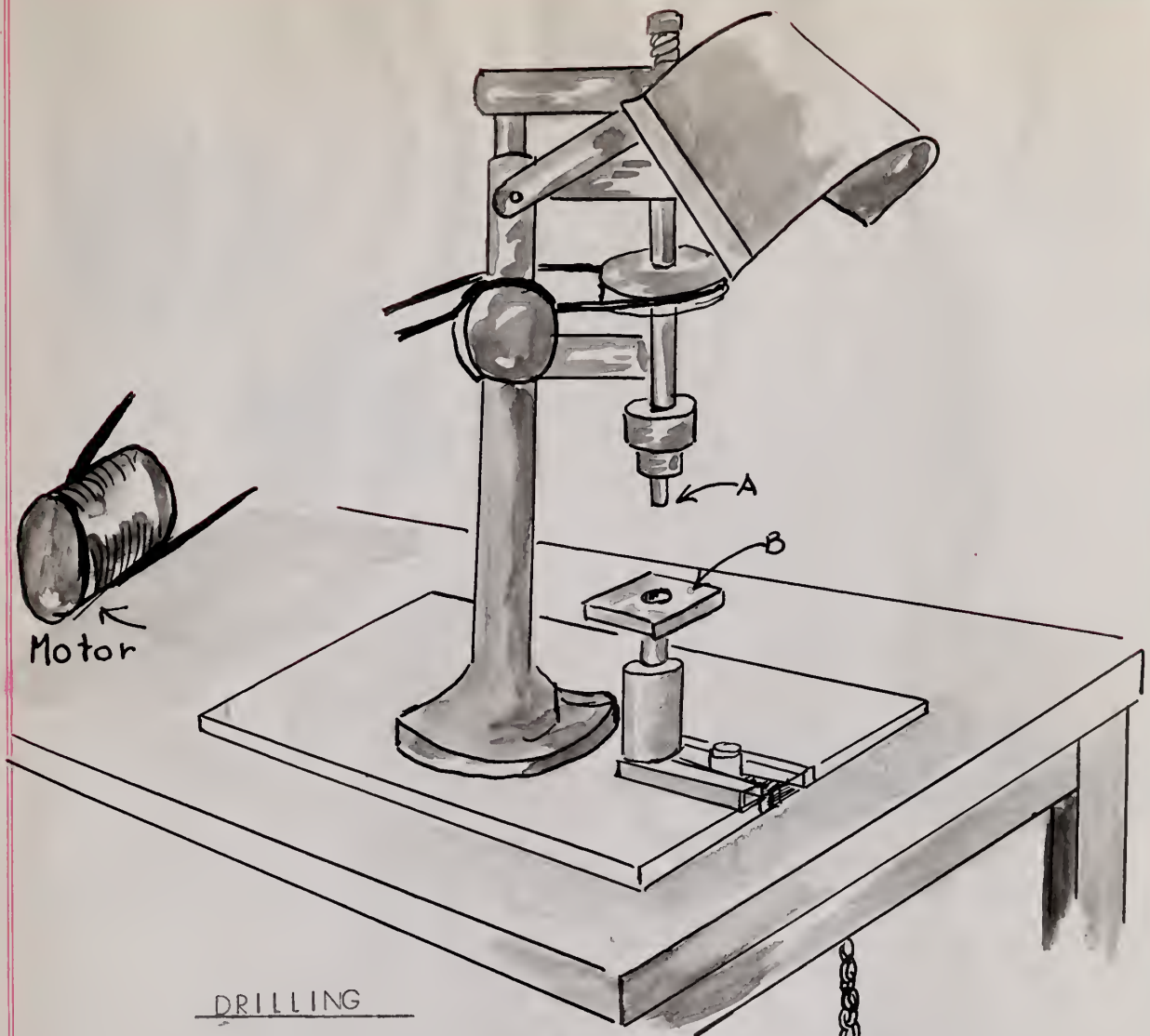


These require only cementing.

Step One: Assemble the pieces, you need five leaves, a center flower, a round flat disk, a pin, and the cement as marked on the jar for the conda perl. Not as heavy as the cement used on the lucite.

Step Two: Just use the paint brush. Allow the cement to run under the parts. Each leaf touches its neighbor. Lay them in place before you cement them to show you where to place the leaves on the disk.

Step Three: Add the center flower, cement in place. Add a cabshon in the center of the flower. When all the parts have set, turn the pin over and add the fastening pin.

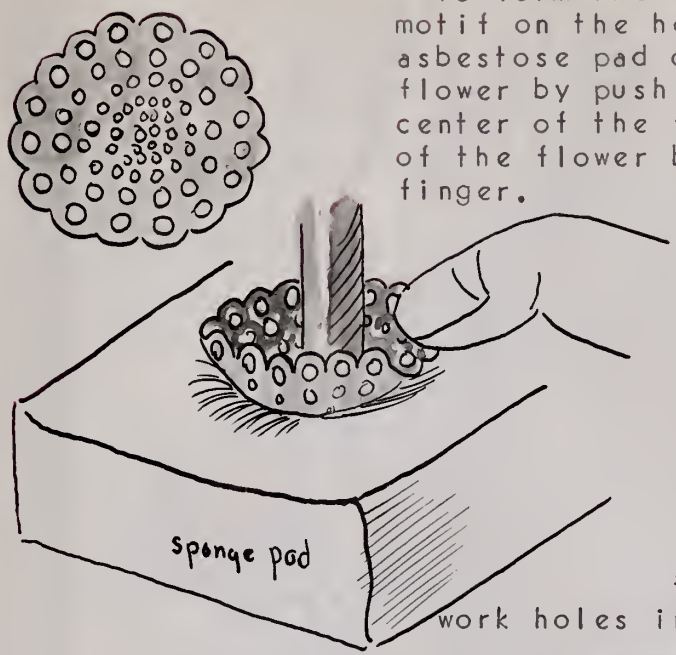


DRILLING

Insert the size of drill to fit the size hole you want in the piece at A.

There is a wooden pedal under the table. Put your foot on this pedal to bring the drill down to the table B. The motor will take care of the drilling. Hold the piece to be drilled firmly; keep your fingers away from the drill. When it is in place, press your foot down on the pedal. When the hole is drilled through, raise the foot; the drill will rise. Shut off the motor by turning the switch which is under the table rim.

LACE CHAIN



To form the flowers, put the flower motif on the heater. (Be sure to have the asbestose pad on the heater.) Shape each flower by pushing one of the rods in the center of the flower. Bend the outer edge of the flower back between your thumb and finger.

The outside flower needs to be more open than the crystal inside flower.

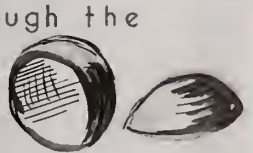
The rosebud in the center may be added when you have completed the chain.

The chain is made of all flower parts, no chain. Attach each flower to the next with two transparent acetate oval rings. Push the rings through the lace work holes in the flowers.

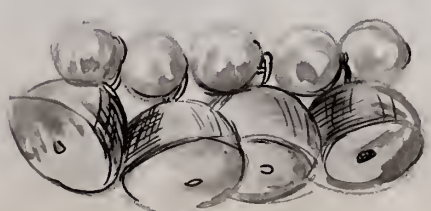
When the chain is the desired length, cement a rosebud in the center of the flower with the acetone. Do not let the acetone run over the flower for it will take the luster from the flowers and dull the transparency of the center flower.

BALLS STRUNG ON BEAD CHAIN

Take two cabshons. First, you must drill a tiny hole in the center of each one. (A cabshon is half a ball.) Cement two of them together to make a ball. Push a head pin through the drilled holes and make a loop using the nail method. Fourteen balls used to make the sample string.

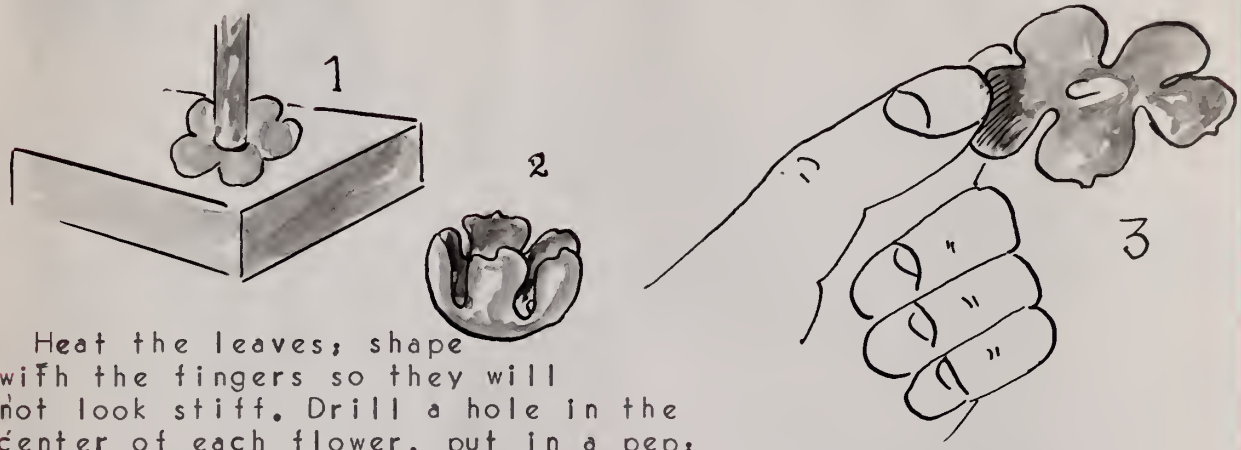


String seven inches of beads. This measurement includes the clasp. Then thread a ball between every two beads. When the fourteen balls have been added complete the other side of the necklace, stringing the same number of beads. Now add the clasp.

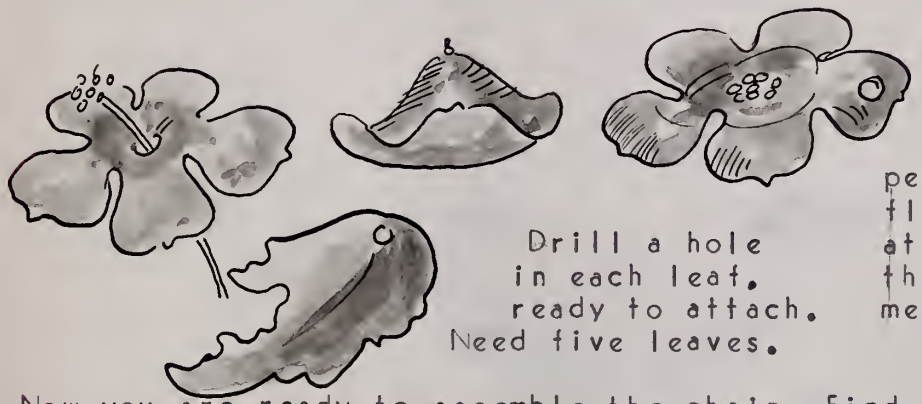


WILD ROSE NECKLACE

Take the flower parts, heat them until pliable. Now, with the sponge pad underneath, press in the center of the flower with a rod. (1) Bend the petals back with the fingers. (3) Shape six flowers.



Heat the leaves; shape with the fingers so they will not look stiff. Drill a hole in the center of each flower, put in a pep; twist the wire on the back and cut the surplus neatly.



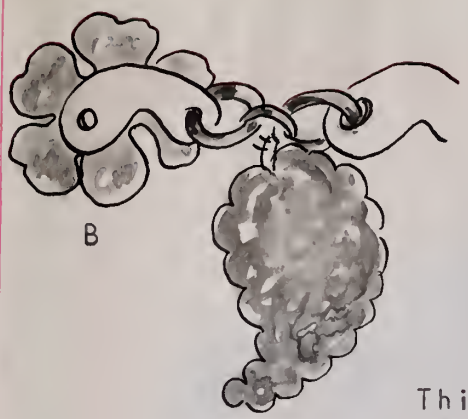
Drill a hole in each leaf, ready to attach. Need five leaves.

Drill a hole in one of the petals of each flower so you can attach the petal to the chain with a metal ring.

Now you are ready to assemble the chain. Find the center link, hang a leaf, put two flowers on either side, skipping a link each time. Use five leaves and six flowers.

Red Flowers On a Beaded Chain with Crystal Leaves

Nine leaves are needed. Heat and shape with the fingers. The flower can be shaped two ways, with a rod or by bending between the thumb and finger. Use the sponge pad if you use the dowel. Press each petal one at a time. A cabshon is cemented in the center of each flower. Each flower is cemented to a base. (A) round rings are now used to attach the flowers to each other.


B

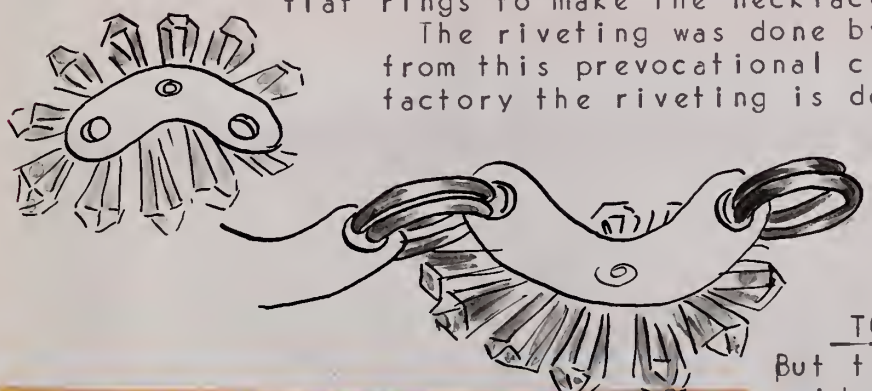
String as many beads as you wish the length of the chain to be. In the back, attach a round ring, knot as before. Then you may add the flower front string that you have just made. Attach the leaves to the round acetate rings with metal rings. B.

CRYSTAL DAISY CHAIN
(Polystyrene)

This is a different kind of plastic. See how clear this crystal is. The material is called polystyrene. The stones are made from this material, too. It is made in all colors and is noted for its transparent beauty.

A special cement is needed.

The flower parts have been riveted for you in the factory. All you have to do is to attach each flower in a chain, and cement an acetate cabashon over the riveted part so it will not show. Seven flowers are needed to copy the sample necklace. Four flowers are needed to make a bracelet. Use the double flat rings to make the necklace.



The riveting was done by a former pupil from this prevocational class. In the factory the riveting is done in one section, the assembling in another part. Thus this work was done under factory conditions.

TO SET STONES

But the stones into the spiders. Bend the metal fingers over the stone with your fingers of the pliers.

Cement a pin onto the base in the back.

Stone-setting

Polystyrene

WHITE POND LILY

The directions are the same for the shaping of the flower parts as those given for the Wild Rose necklace, but the assembling is different. .

Heat and twist base A . Cement a flower onto the straight part of A. Eight flowers and nine leaves are needed.

Bend the leaves as before. Measure seven inches of chain, including the clasp. Use the metal rings to attach the leaves. The leaf is hung from the second link, attach two more links, the third link is put through the hole in the base A that holds the flower.

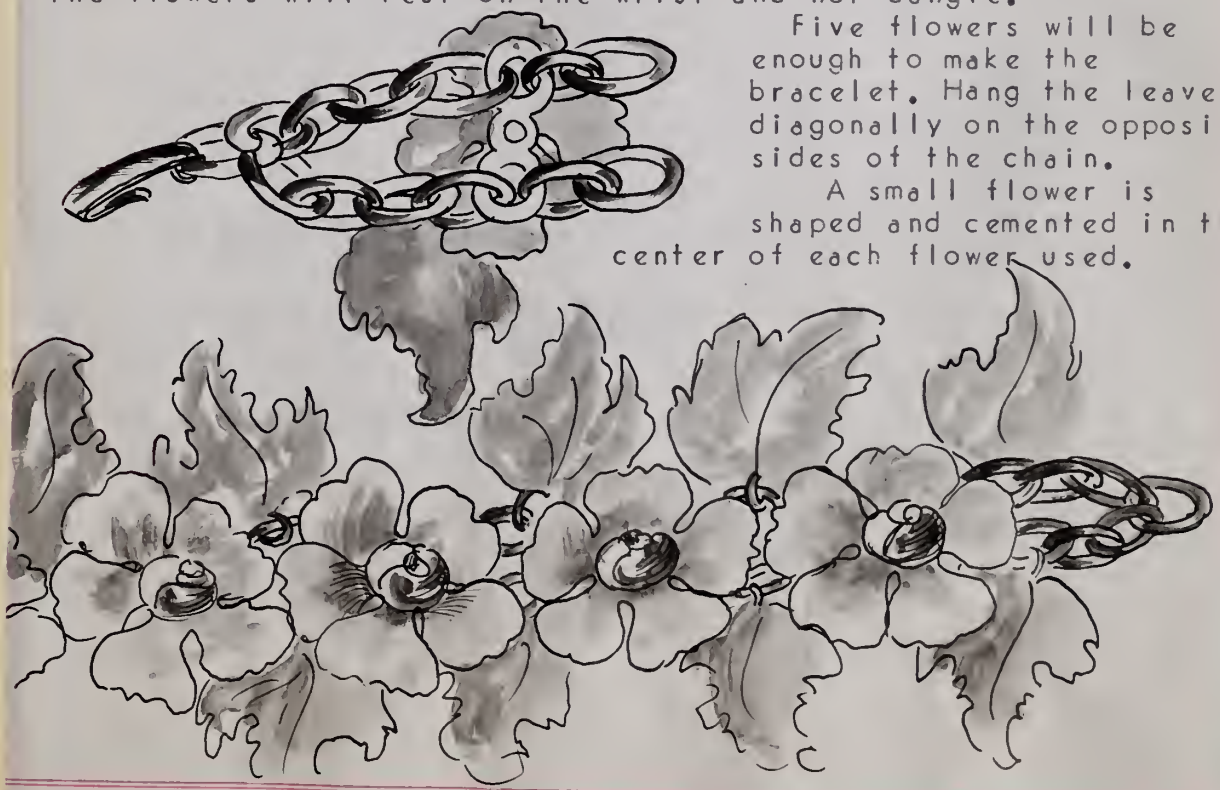
Hang eight flowers and nine leaves, then continue the back of the chain to match the other side. Be sure to cement the rings with acetone so there are no openings. Must take special care that the rings holding the flower parts are cemented.

When you make the bracelet, do not twist the base A, as you did to hang the flowers before. This time the flower is cemented to the center of the base and the base is kept flat.

The small oval rings are used forming a double chain, so the flowers will rest on the wrist and not dangle.

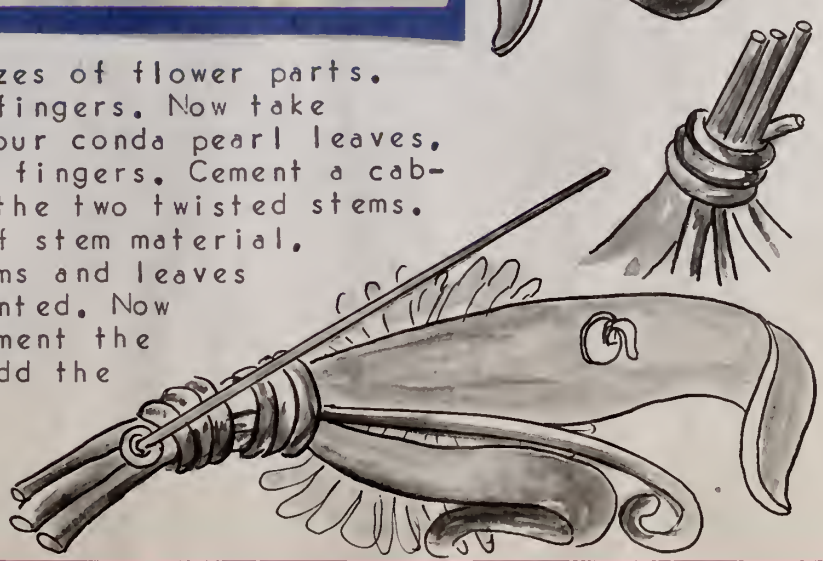
Five flowers will be enough to make the bracelet. Hang the leaves diagonally on the opposite sides of the chain.

A small flower is shaped and cemented in the center of each flower used.



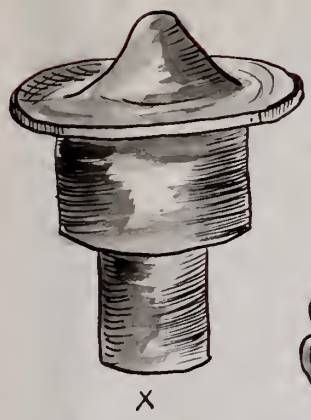
Chrysanthemum

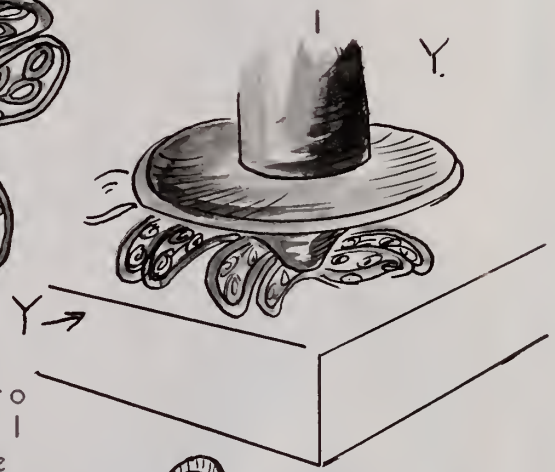
Take three sizes of flower parts. Heat and bend with fingers. Now take three stems. Take your conda pearl leaves, heat and twist with fingers. Cement a cabshon on the end of the two twisted stems. Heat three pieces of stem material, wind around the stems and leaves which you have cemented. Now you are ready to cement the flower. When set, add the pin parts. Be sure the hook disk is placed within the point of pin, to hold.



The Tourquoise and Crystal

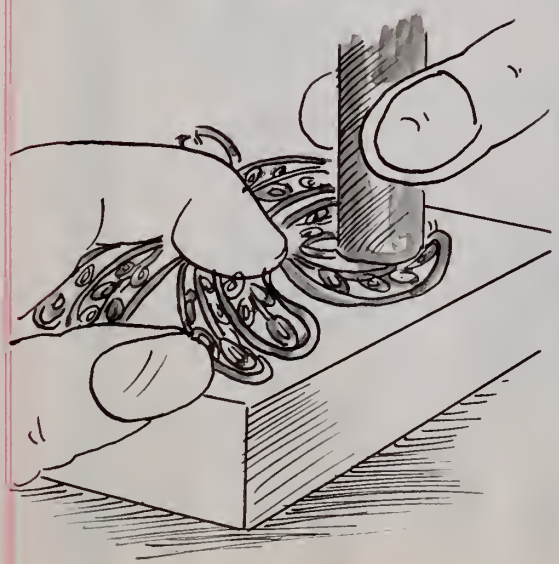
Use two sizes of plastic flower parts, the two-inch and the one and one-quarter inch flower. To shape these, use the sponge pad and the die shape that is like a Chinese hat. "X".





Press into the center of the heated part. Press each petal gently with a rod on the back 2, to bend it. Do the same with the small flowers. Shape the leaves with the fingers. Cement A on the back of each flower, but heat this first, as you did before, then twist makes the flower hang better. Cement a cabshon in the center of each flower.

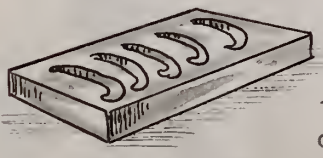
2



Measure the chain the length you wish it. Have seven flowers and eight leaves. The leaves are attached to the chain with metal rings. Be sure to acetone the rings of the chain that hold the flowers so that they will not fall off. Use round molded acetate rings for this chain.

THE CONDA PERL PINS

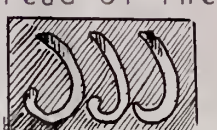
Take the conda perl rods, measure the stem lengths. Soak these in a pan of hot water. The water must be kept very hot. Keep hot in a pan on the heater. Use the pliers or a stick to remove them from the water. Lay the removed parts, while hot, into the groves cut in the board. When shaped remove them and drop the stems into a pail of cold water to set them more quickly. Dry with a cloth.



Cement the stems to the back of the flower. Add the small shaped flower in the center. These were shaped in the factory on the swedging machine. You will learn how to do this later. Cement a cabshon, which is a half ball, onto each petal and in the center of the flower. Use heavy cement. Add the pin next time you have class. The pin needs to set over night.

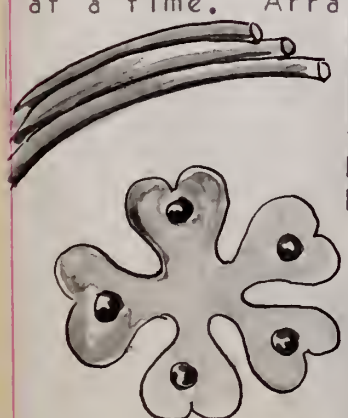
Conda Perl Pin

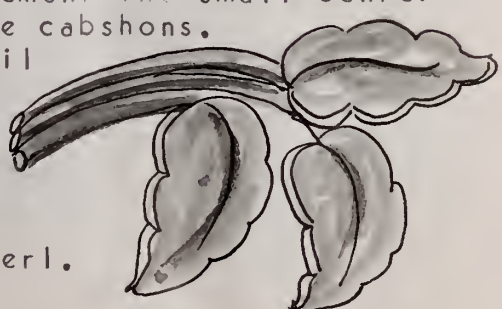
This one is made just as you made the last conda perl pin. Leaves are to be added this time. Cut and shape the stems. You may heat the cut pieces on the heater instead of the hot water method if you wish.

Cement the stems together, hold firmly  in place with the fingers until set. Then add the leaves, one at a time. Arrange them where you want them to be.

Now add the flower. Cement the small center flower in place and the cabshons.

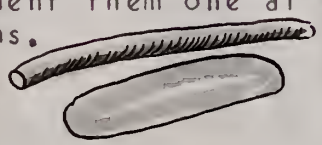
Let the pin dry until the next class meeting before you add the bar pin onto the back of the pin. Use the special heavy cement made for the conda perl.

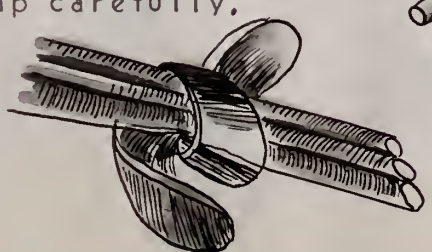




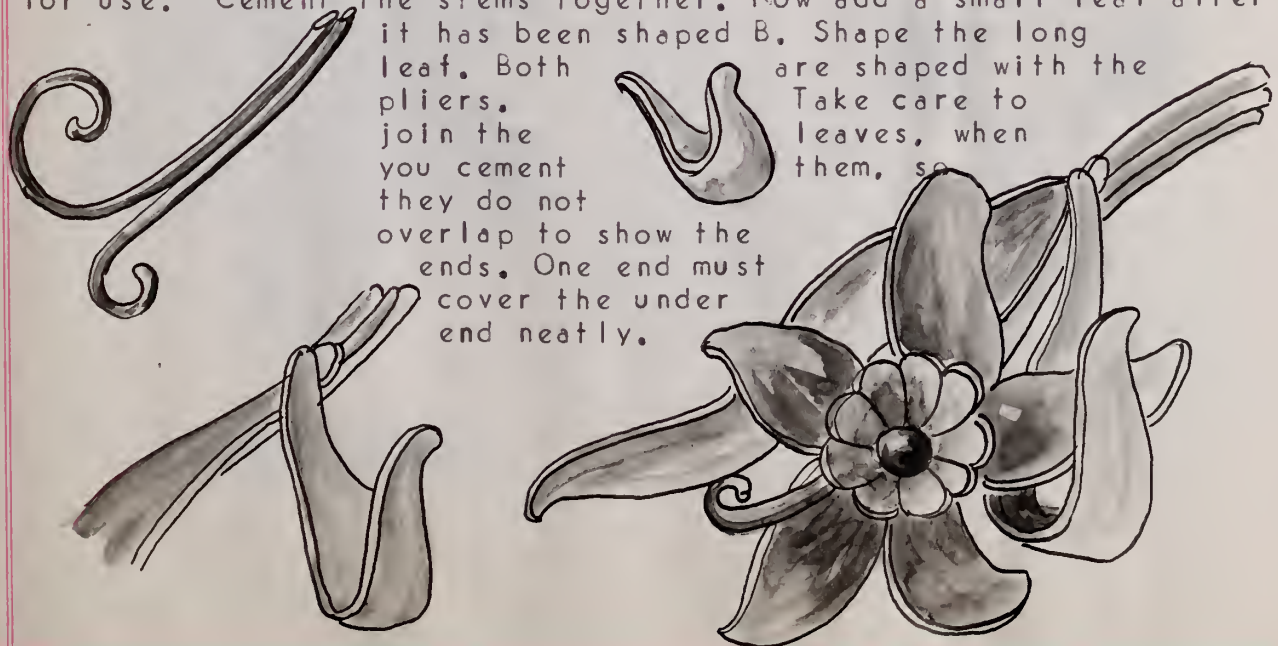
LEAF PIN

Arrangethe stems; shape the leaves with your fingers. Arrange them to lie in a natural position. Do this before you cement them to the stems. Cement them one at a time. Cut a piece to wrap around the stems. Heat this piece then wrap carefully, giving the end a twist with the pliers.

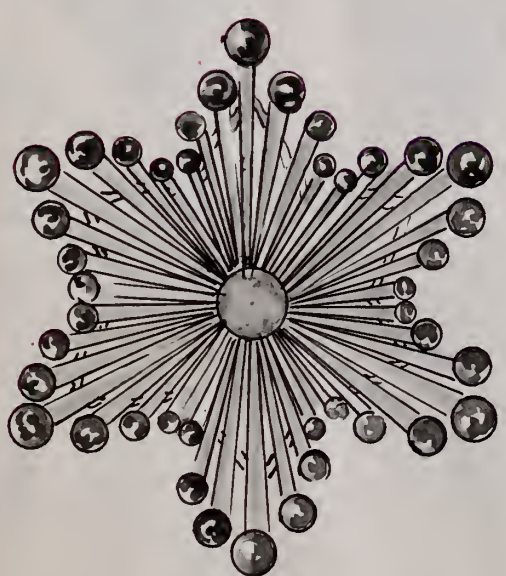


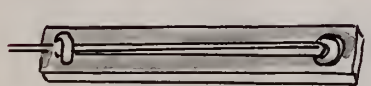


Cut lengths of stem. Shape them by soaking in hot water then put them into the groves in the board. Drop them into a pan of cold water to set the shape. Take a flower part, which is ready for use. Cement the stems together. Now add a small leaf after it has been shaped B. Shape the long leaf. Both are shaped with the pliers. Take care to join the leaves, when you cement them, so they do not overlap to show the ends. One end must cover the under end neatly.



THE PINK STAR PIN





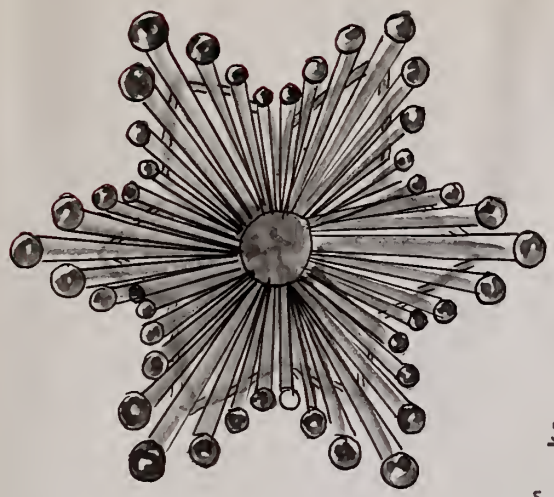
The flower part on the bottom is not shaped. Shape the next two with the die A, pressing the flower parts into the sponge pad.

The center flower must be more closed than the middle flower so use a dowel in the center of this one and pinch the outside balls with the fingers to close the petal parts.

Cement the four flower parts on to each other with acetone and the brush.

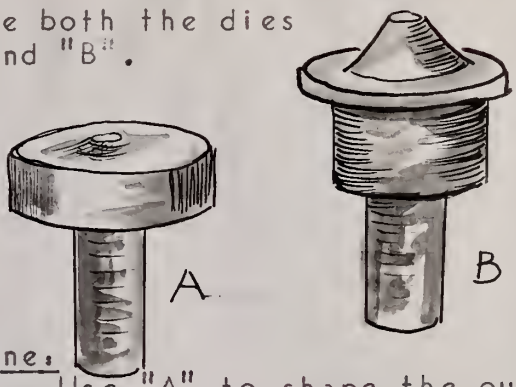
Use the bar pin on the back.

STAR WITH BALLS ON THE ENDS



You need twelve flower parts for the necklace (Two for each flower). Only four for the bracelet.

Use both the dies "A" and "B".



Step One: Use "A" to shape the outside petals. Heat the flower parts, put one onto the sponge, press "A" into the center of the flower part. Bend the balls back with the fingers.

Step Two: Use die "B" to shape thecenter flower part. This will make a deeper center. Cement a small cabshon in the center of this flower part.

Outter Flower

Inner Flower

Cement both flowers together, then cement them to a curved base. Use oval acetate rings to attach the flowers together.

Assemble five inches of chain, including the clasp, then attach five flowers. Continue the other side of the necklace with five inches of chain.

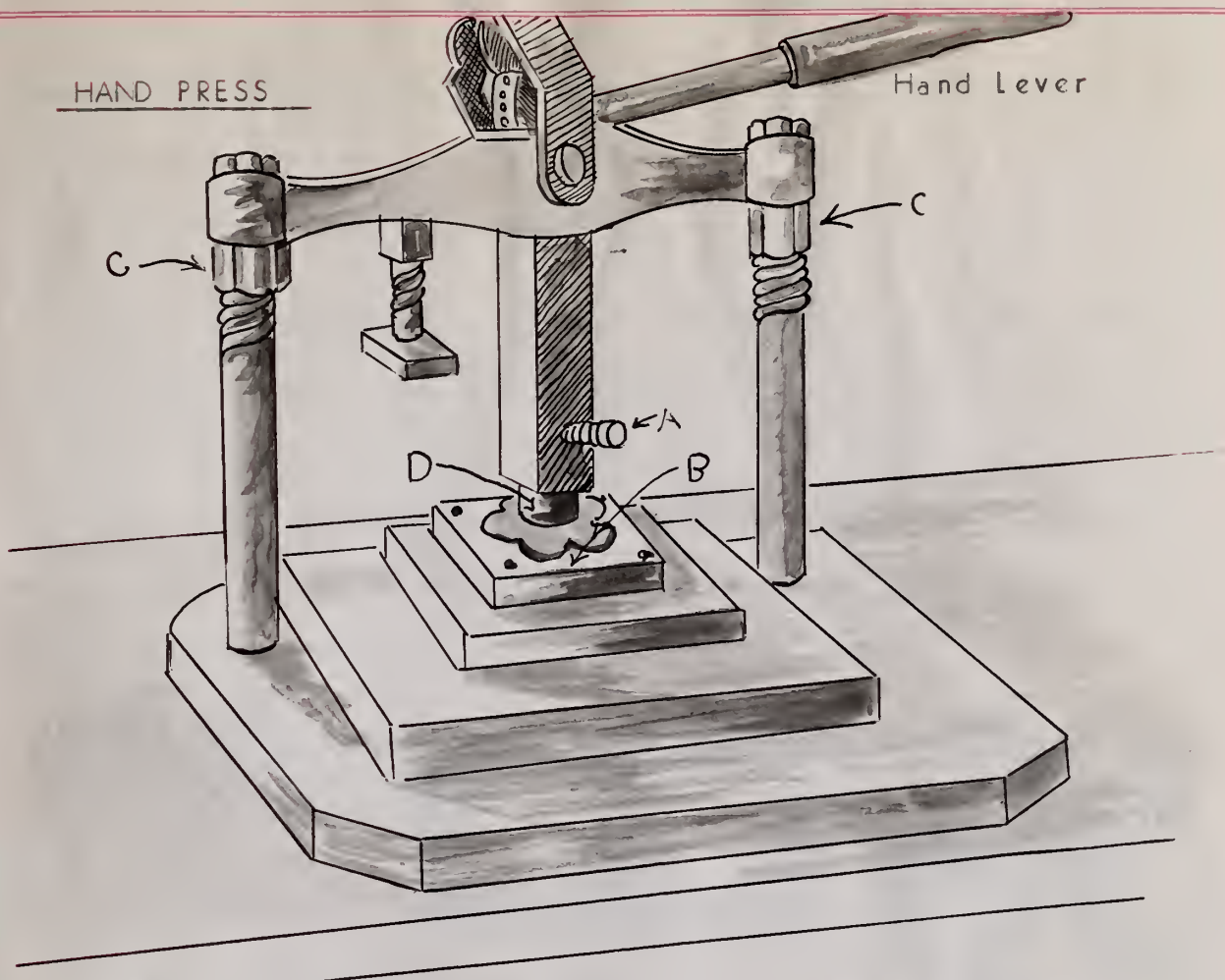
BRACELET

The only difference is that you use the bracelet base, which is straight, for assembling. Use a single round ring to begin. Adouble chain of oval rings is used for the bracelet foundation. A single ring at the other end then the clasp.

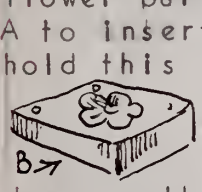
Bracelet Base

Beginning

End



For swedging, use the hand press. Swedging is shaping the flower parts. Unloosen the nuts at C to raise the bar. Unloosen A to insert the upper part of the die into D. Tighten A to hold this part firm. Place the lower part of the die B directly under D. You may have to build a platform of wooden blocks, as shown in the illustration. When they meet easily, tighten the nuts C. Test by pulling down on the lever handle to be sure the upper part of the die fits snugly into the lower die. Now you are ready to work.



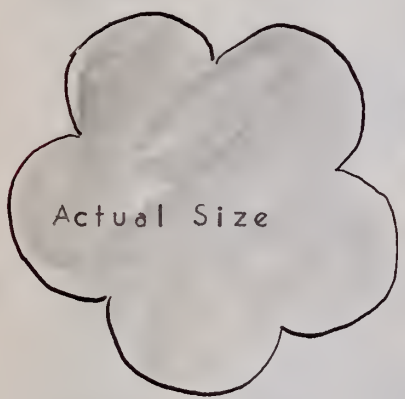
Heat the flower form that has to be shaped. Place it onto the base, die B. Pull the lever down with one hand or both, as needed, release; then drop this shaped part into a pail of cold water. Then take another piece which has been on the heater while you were using the machine. Notice that this process of swedging is like the hand swedging you have been doing with the dowels, your fingers, and the hand dies, the results are the same. In the factory the swedging machines operate under the same principle only the machine is operated with your feet so that both your hands will be free to place the parts to be swedged on the lower die.

BLANKING AND POLKING

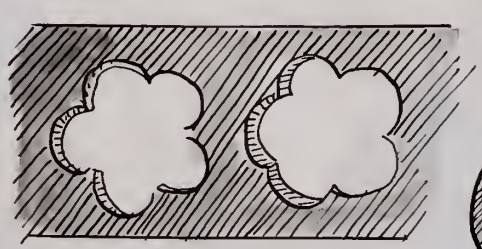
You have seen your mother cut cookies. Polking parts is what this process is called in the factory. This is what you

are going to do now. Use the same machine as before, only this time insert a cutting die in "D"; tighten as before. Place a block of wood under the cutter, there is no lower part to the die.

Heat the strip stock, place under the cutter "D", pull the lever down, press hard. The flower will be cut like a cookie. If you are quick you can cut three or four flower parts before the stock need be reheated. The material can only be cut when in a pliable state. The cutters are very sharp, keep your fingers away from them.



Blanked Piece



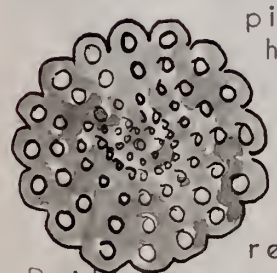
Stock when parts have been cut out.

Swedged Part

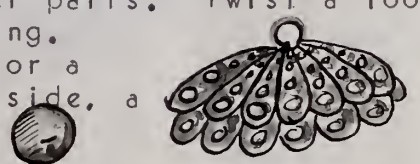
THE RED FILIGREE WITH WHITE CENTERS

Shape each of the filigree parts using a dowel and the sponge pad. Drill a hole in the center of each flower part. Push a head pin through a red bead then through the drilled holes in the two flower parts. Twist a loop on the back for assembling.

The sample calls for a red flower on the outside, a white one inside and a red bead. You may reverse the order if you wish. If you do so use a white bead in the center of each flower.

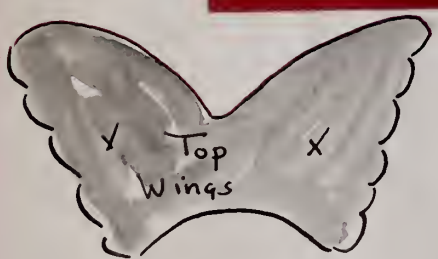


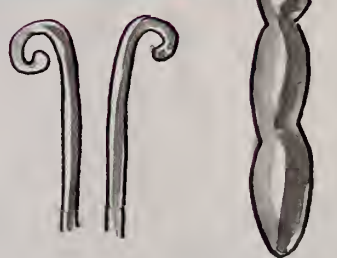
Drill a center hole



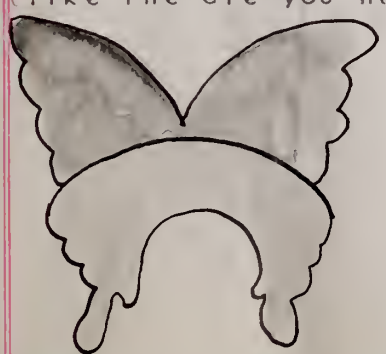
Two Flower parts

Conda Perl Butterfly





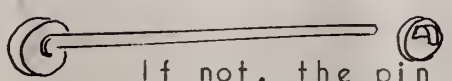
The wings have been swedged at the factory. If you had to swedge them, you would need the die to insert into the machine, like the die you have used.



Drill two holes in the head to put the feelers in. Cement them in with the heavy cement.

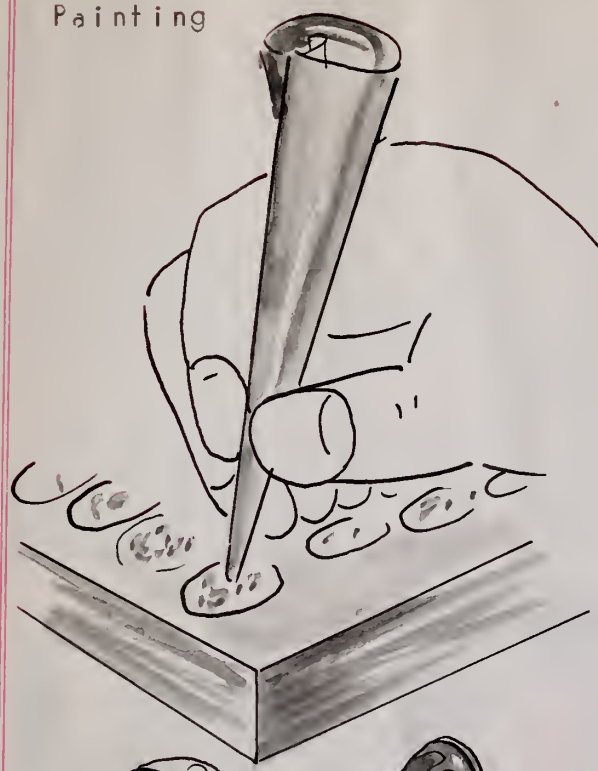
Cement the lower wings onto the top wings. Now cement the body on the front.

Use the two part pin, each part is on a small acetate disk. Cement to the upper wings at X. Be sure the hook is down. If not, the pin will not hold.



PAINTING

Tube Painting

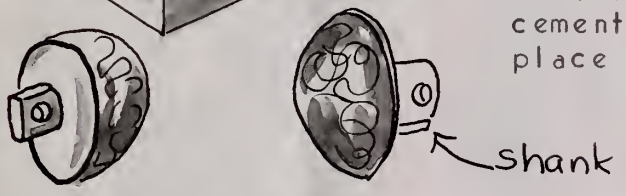


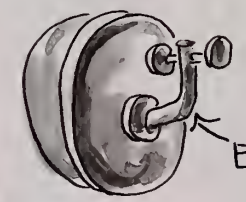
When painting with the tube, mix your paint first in a small container. An empty poster paint jar is good to use. Do not have the paint too thin or too thick or it will not flow from the tube easily.

When the right consistency pour into the tube. If you want a tiny dot, have the tube tightly rolled at the end. If a large dot is needed unroll the tube a little until the paint comes out the right amount. Acetone will thin the paint. Mix only a small amount of paint at one time for the acetone evaporates.

Paint some buttons to be used for earings. Use either the tube or the brush.

To make earings; neatly snip off the shanks from the buttons. Be sure the surface is smooth. cement ear clips onto this smooth place with acetone.

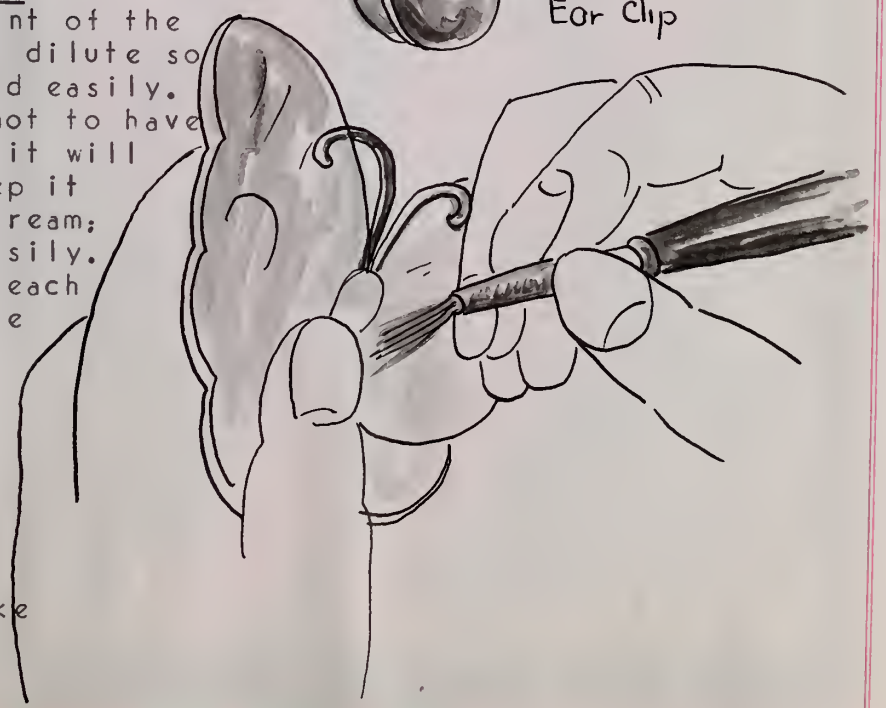




Brush Painting

Pour a small amount of the paint into a saucer, dilute so the paint will spread easily. Care must be taken not to have the paint runny for it will spoil your work. Keep it the consistency of cream; then it will flow easily. Only practice will teach you how to handle the paint. The paint is made from acetate plastic material, diluted in acetone.

The tubes are made from oblong strips of tin foil. Rolled between the finger and thumb like you make a cone.



THE LOVE BIRDS

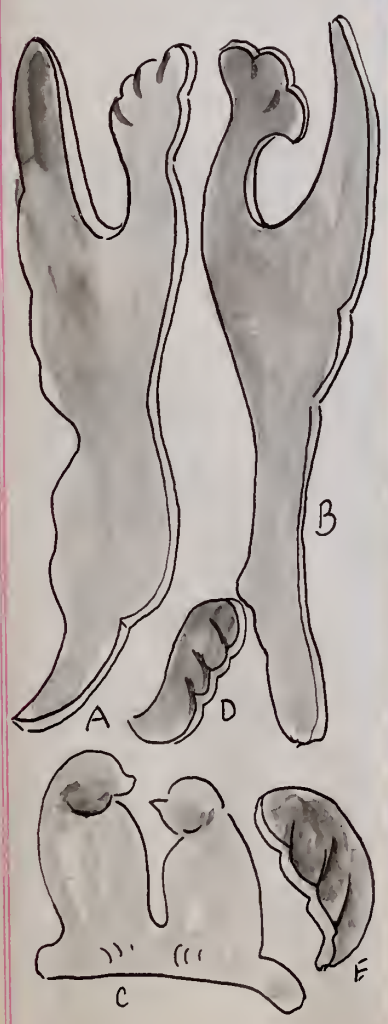
Assembling and cementing project

Find the parts to assemble. Now you are ready to cement. Cementing is like painting but care must be taken not to use too much acetone. Too much acetone will overflow onto the front of the perline and will take off the shine, may even take the color. Watch this in every cementing job you do.

Pour a little acetone into a saucer: hold the pieces to be cemented, with your fingers; add the acetone with a paintbrush, just enough to flow between the two pieces you are cementing. You may have to hold them a minute until the acetone dries. Then lay in a place where it can really set and not be moved. The perline takes a little longer to adhere than acetate.

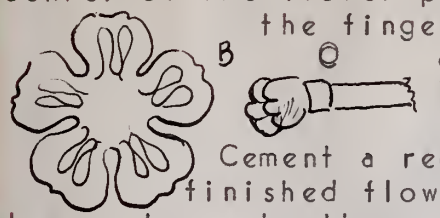
Directions

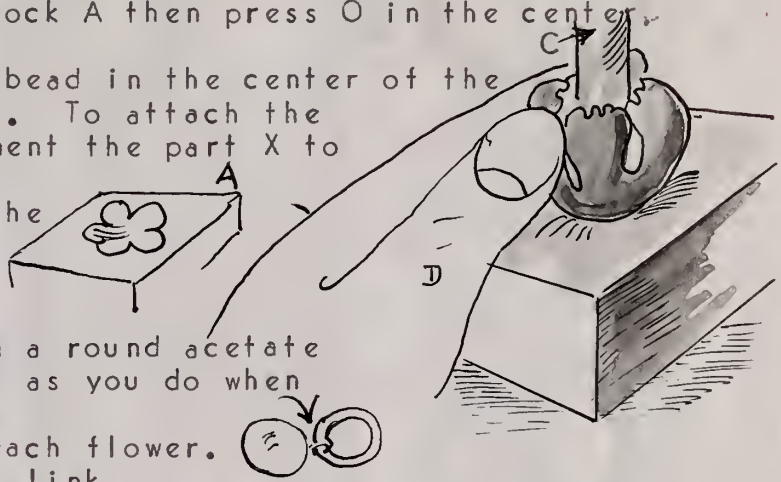
Cement the two wings "A" and "B" onto the bodies of the two birds. Now cement the smaller wings C and D. Later, when you are taught to paint with a tube, you may add the eyes in black. When the parts have set, add the pin on the back.



RED AND WHITE NECKLACE

Nine flowers for the necklace. Press the rod C into the center of the flower part B, and almost close the petals with the fingers. D. Use the metal die O to shape the outside flower. Lay the flower onto the block A then press O in the center.



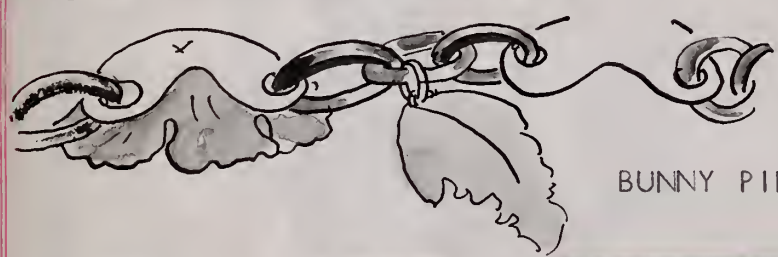


Cement a red bead in the center of the finished flower. To attach the flowers to each other cement the part X to the back of each flower.

Shape the leaves with the fingers. Drill a hole at the top of each leaf to assemble it to the chain.

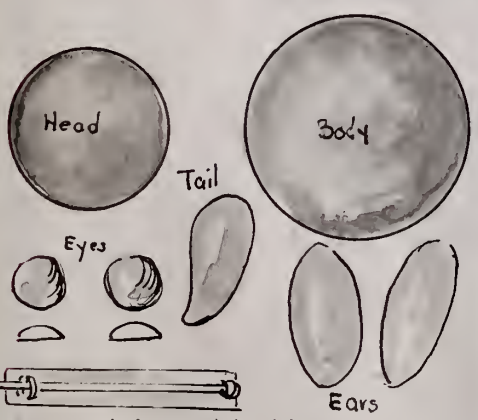
String nine beads , then a round acetate ring. Make a knot and end as you do when making a beaded necklace.

Put three links after each flower. Hang a leaf in the center link.



When assembled brush the edges of each petal with red paint.

BUNNY PIN (A cementing project)

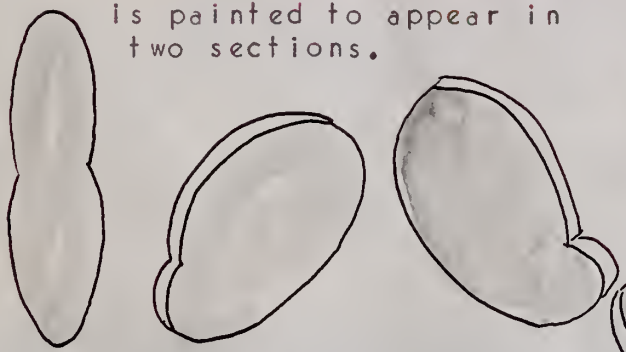


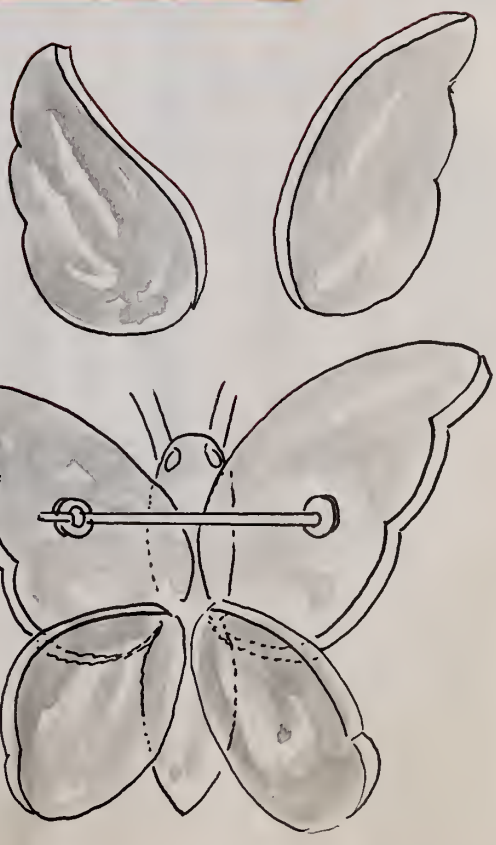
Assemble all the parts and cement with the conda perl cement. Each part has been swedged for you.

Paint like the sample. Use the tube to make the eye.

LUCITE BUTTERFLY

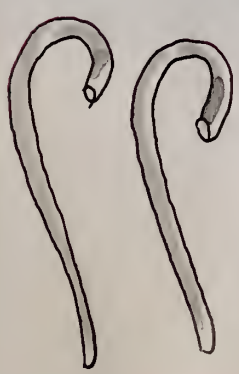
Four wings are needed. The body is painted to appear in two sections.



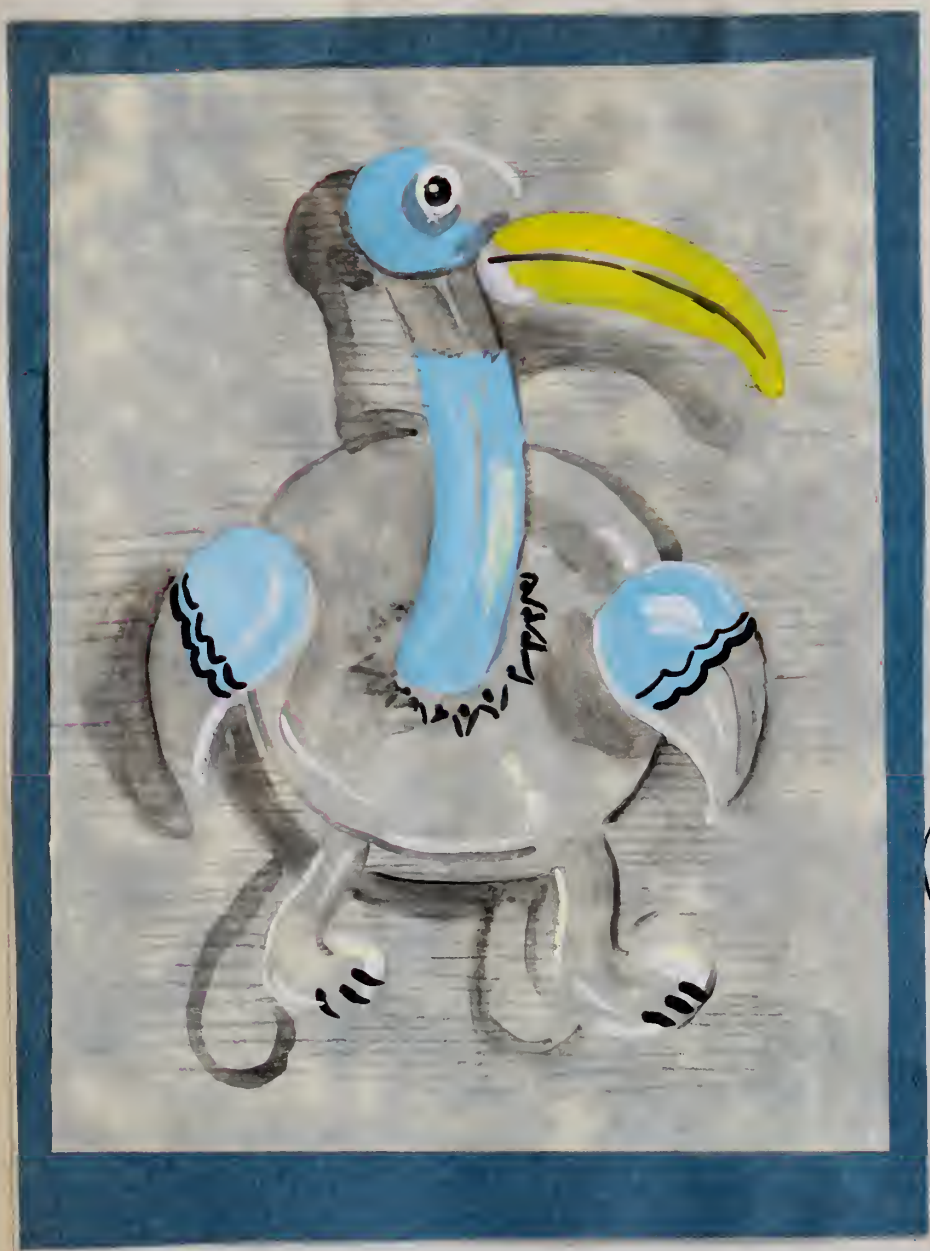


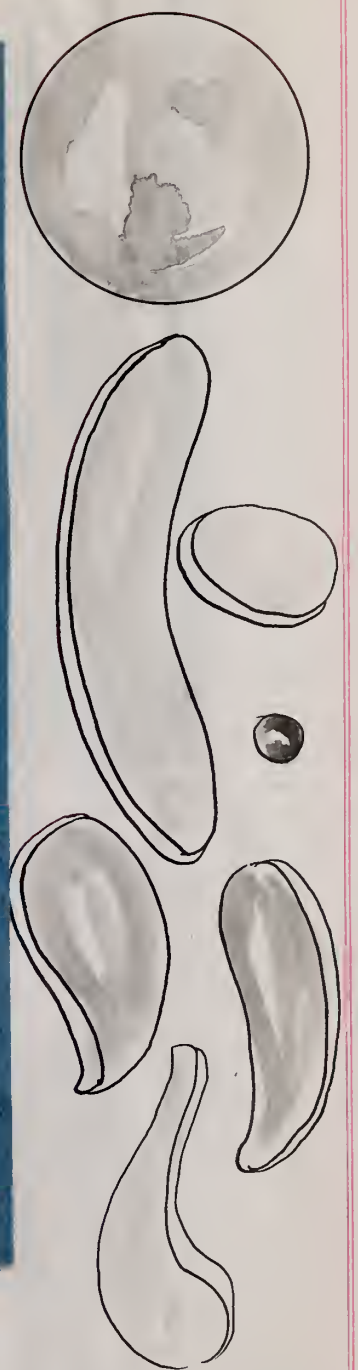
Assemble all the parts. Cement them in place useing the heavy lucite cement. Let it set over night before you paint the butterfly.

Try for nice clean lines. Use a small brush and not much paint on it.



The Duck

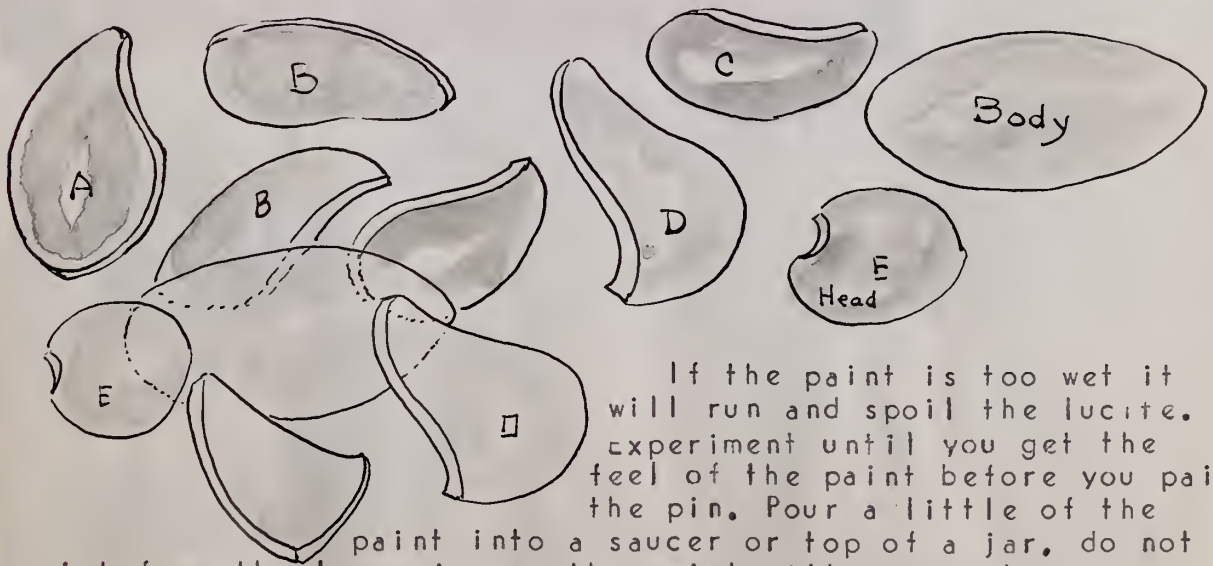




Find all the parts. Shape the wings and the legs. The disk for the body was shaped in the swedging machine. Assemble all the parts and cement into place like the sample. Use the special lucite cement. When set you may paint the duck like the sample. Better to wait until the next lesson.

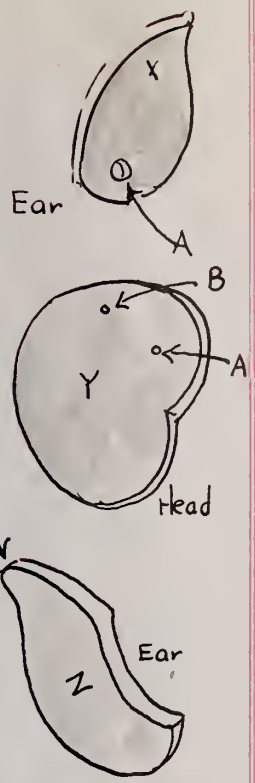
Assemble all the parts, arrange in their proper place, then cement. Use the heavy special cement. The jar is labled. Put on with a paint brush or dip the ends to be cemented, into the cement.

Paint the next time the class meets, allow the parts to cement firmly first. Have the paint the consistency of cream.



If the paint is too wet it will run and spoil the lucite. Experiment until you get the feel of the paint before you paint the pin. Pour a little of the paint into a saucer or top of a jar, do not paint from the large jar as the paint will evaporate.

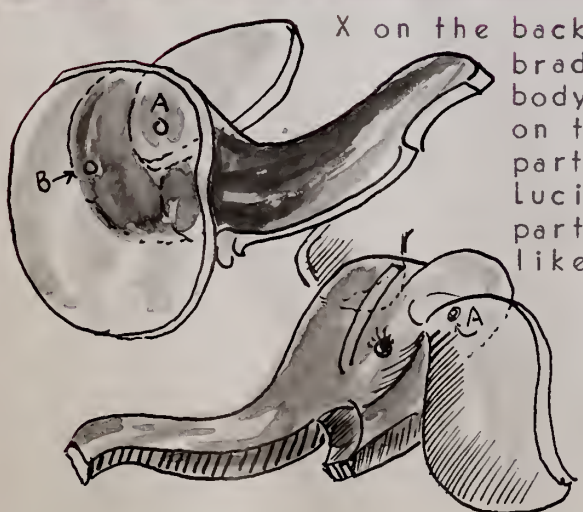
-LUCITE AND WOOD ELEPHANT



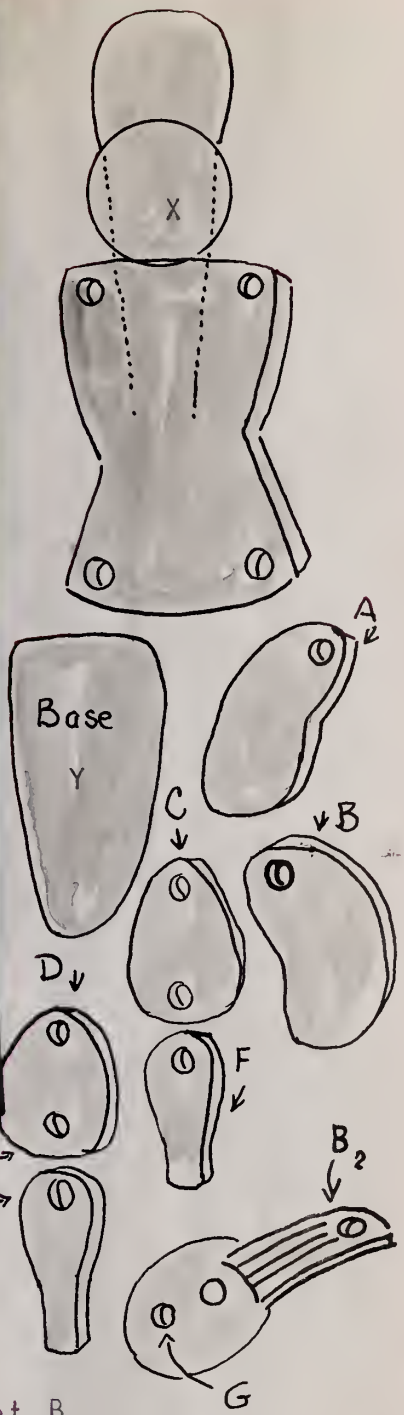
Bend the ears then twist the tip with your fingers, or the pliers.

Drill a small hole at A on the ears and on the body disk. B.

Now carefully place the ear

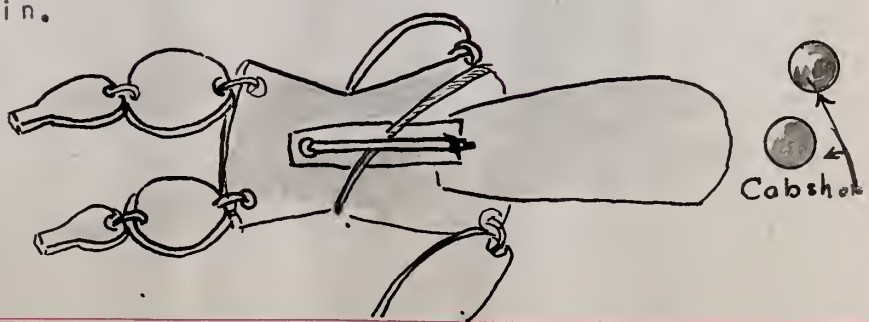


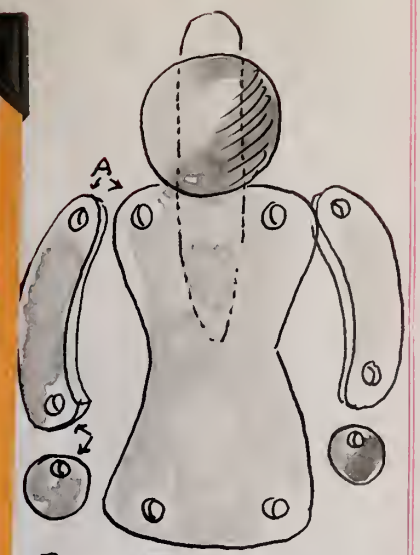
X on the back of the wooden head. Hammer a brad through both parts at A on the body and A on the ear. Ear Z is nailed on the front of the head. The other parts are cemented into place with the lucite cement. Do not paint until the parts have had time to adhere. Paint like the sample.

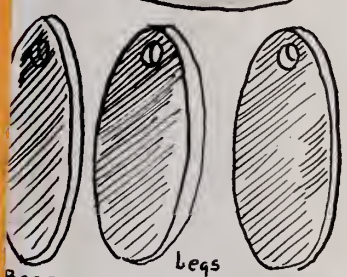


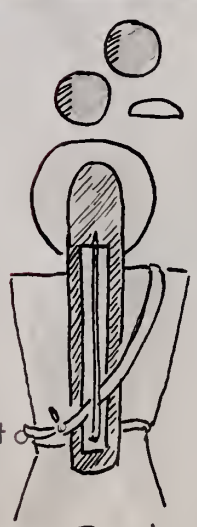
RUSSIAN SINGER

Cement a pink half inch cabshon for the face on the brown piece (Y) at x. Then cement the body Z onto the base. When set assemble the arms and leg parts. Use metal rings to attach these parts. Measure enough cordett, red and yellow, to go over the shoulder on the back over the pin bar. Tie the ends to the mandolin at B and G. Use a bar pin.









The Soldier

The soldier is the same type of pin as the Russian pin. Use a plain piece of acetate as a base to cement the body and the head in place. The hat is cemented on top of the cabshon head. Allow the base to protrude far enough above the head to act as a base for the hat also.

Attach the legs and arms to the body with metal rings.

Measure enough cordett (this the name given to the string or cord you are to use.), to go over the shoulder and around the waist; tie the ends in the back. Do this AFTER you have cemented the pin bar. The cordett is drawn over the base of the pin bar.

PINK LACE WITH WHITE LACE CENTER

Four used in making a bracelet.

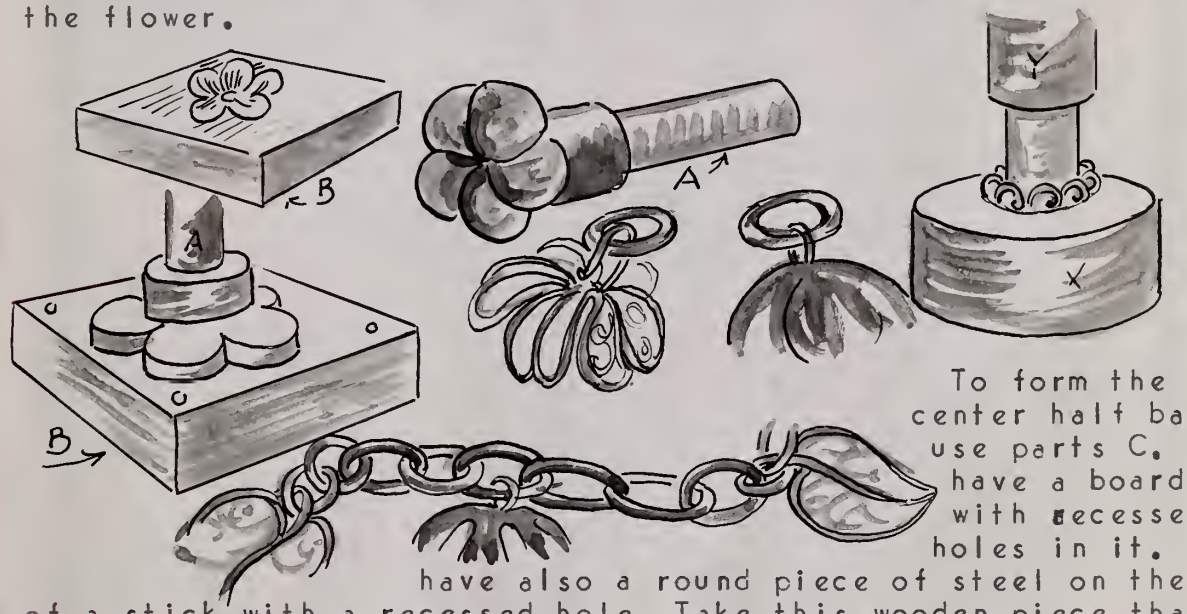
Six needed to make the necklace.

Seven flowers for the necklace. Four flowers for the bracelet. no leaves for the bracelet.

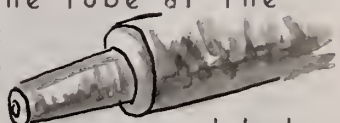
Shape six leaves with the fingers.

Step One:

Shape the flowers with the die. Heat the flower, lay on the base B, then insert A is pressed into the center of the flower.



To form the center half balls use parts C. You have a board with recessed holes in it. You have also a round piece of steel on the end of a stick with a recessed hole. Take this wooden piece that looks like a finger. The hole is made to fit the tube at the end of part C. The tube will fit inside of the finger. Heat C , fit stem Y into the finger, lay C onto the Board or steel die X, over the recessed hole, press gently. Now you have a half ball. Attach these half balls to the centers of the flowers with head pins, this will form a loop for you to use to attach the flowers to the chain.



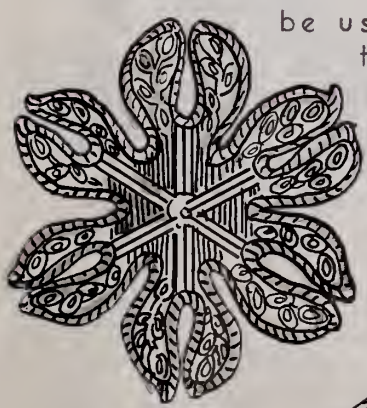
Measure twenty- two inches of chain, including the clasp. Hang a flower in the center of the chain, skip two links on either side then hang a leaf, use a metal ring. You may use a plastic ring if you prefer one. Skip two rings between each flower and leaf, work from side to side until all the parts are assembled.

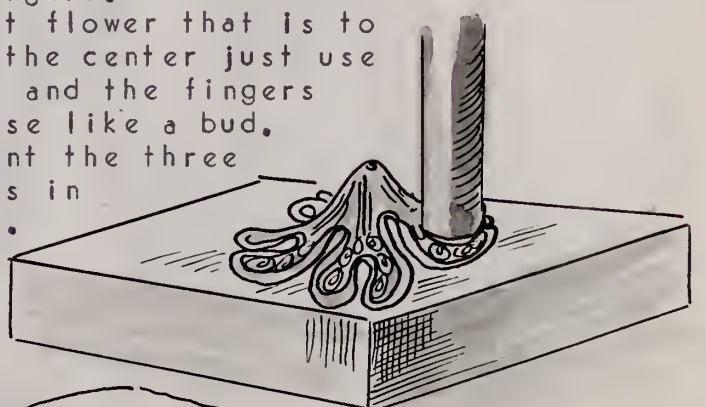
Red Filigree Pin

Three sizes of the flower part are needed. Use a rod to press in the centers of two flowers, press on a sponge pad. Turn the flower over and use the rod to press each petal. Then pinch the petal parts with the fingers.

The smallest flower that is to be used in the center just use the rod and the fingers to close like a bud.

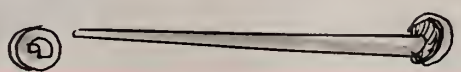
Cement the three flowers in place.





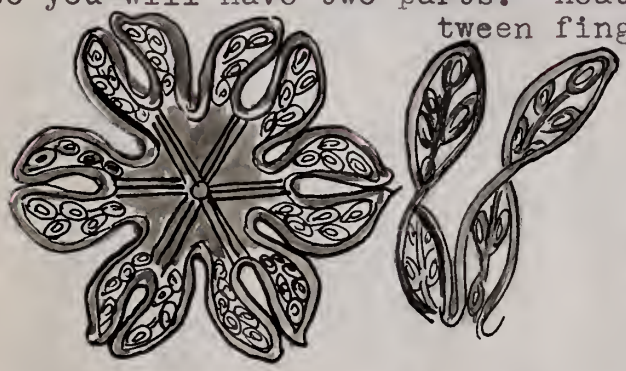
Pinching the ends.

Use a two part pin.



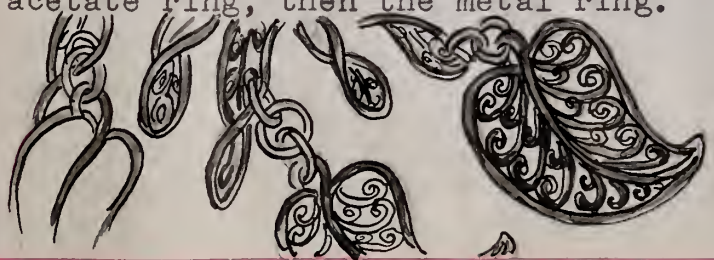
Twisted Chrysanthemum

Use two sizes of this form. so you will have two parts.



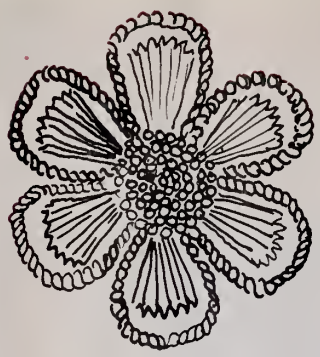
Cut the tops of the petals at A Heat and twist between finger and thumb.

Do this to every petal. The center ones bunch together. Twist three leaves with finger and thumb. Attach two rings to the center leaf and then a metal ring to the flower part; to each of the other leaves, just one acetate ring, then the metal ring.



Use two-part pin.

Flower on a Molded Base

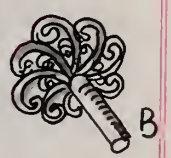


Heat the base A, shape the leaves with a rod or with the fingers to take away the stiff look. Shape the bow by bending the long tabs. B. Fold C up over the joining neatly.

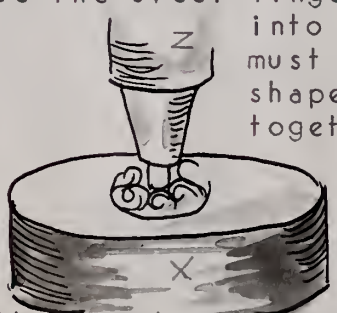
Heat the flower part, shape with the fingers bringing the inside of the petal towards the center, leaving the outside rim of the petal as it has fallen when shaped with the dowel.

Shape part D and cement in the center of the flower. Cement the completed flower onto the stem base at Y.

Balls and Leaves



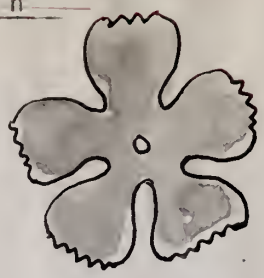
To make the balls, take two pieces A and B. Notice one of the tubes is made smaller so as to fit inside of the other. Use the steel finger Z to press the parts into the hole in X. The parts must be heated first then shaped. Fit the half balls together and cement with acetone. Put a head pin through the ball, make the loop for assembling.



Shape the leaves enough to take the stiff look from them. Copy the sample. Arrange the leaves and then cement into place. Use round acetate rings to attach the balls to the leaves. A hole must be drilled in one of the solid leaves to hang one of the balls. Cement a bar pin onto the back.

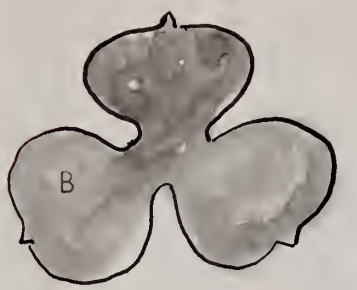
The Basket Chain

Four flower parts are needed. Heat and shape each piece in the center of each flower.



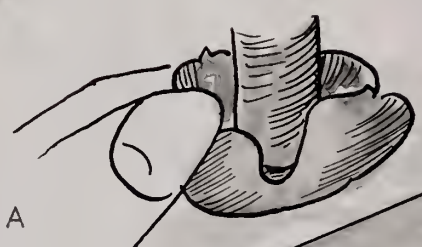
Flower Shape

Drill a hole with a dowel and the fingers on the pad. A

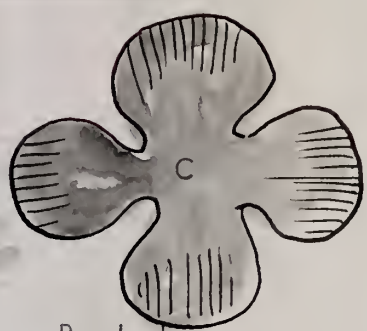


Basket Part

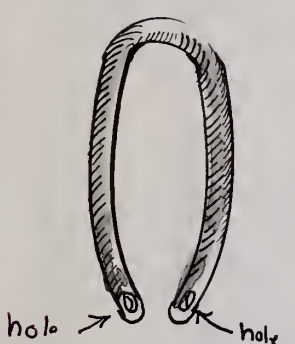
Two parts are used to make each basket. One cemented inside the other.



A

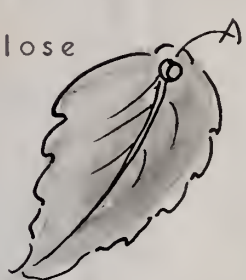


Basket



You will need three baskets, two made using parts C the center basket made with the parts B.

Two holes must be drilled close together in the bottom of each basket.



Drill a hole in each of the leaves, three are needed.

A piece of round rod is to be cut for the basket handles. Heat and shape these with the pliers. Drill a hole in each end of the handle. Take a piece of wire, push it through the holes in the handle and the holes in the basket, twist the ends of the wire on the back of the basket. Cut the surplus wire neatly. Use the clippers to do this. Metal rings are to be used to attach the baskets. The flowers and the leaves are attached at one time with a yellow pep. Twist the ends and clip neatly.

Basket

Basket

DESCRIPTION OF THE EXPERIMENTAL TEACHING

Two mornings a week for a period of four months were needed to teach each child how to handle the materials, tools, and the machines. In this time a duplicate piece of all the jewelry and some originally designed pieces were made. Only one necklace was designed to use the polked pieces (illustrated on page). The children designed many more. They made bracelets and pins, also, from the polked pieces. At the end of the four months the cutter and the swedging die were returned and others were borrowed in their stead. Many beautiful jewelry pieces were made as a result of this.

The pupils were so pleased with the work they begged to do it every day. They asked to remain after school to work, and many afternoons they had to be shooed home. The teacher reported that all their studies benefited by this project. The work was integrated with their English, spelling, and arithmetic lessons. The children were just as enthusiastic in April as in September. The teacher said the project challenged them all to do their best, even the slowest in the group. One boy, at the beginning, was very clumsy in handling the pliers. The necklace pictured on page bothered him. When he was told that he need not make that one he was indignant and asked to stay after class to make it. Such pride has never been displayed by any one else as that shown by this boy when he

The Prevocational Class ..... December 1943

had finished the necklace and bracelet. They were just as well done as the sets made by the other members in the class.

his necklace seemed to be the only one that bothered anyone. The girls took to stringing and assembling as ducks take to water. The boys liked doing this as well as the girls. They were especially interested in the machines. The boys took care of the cutters and dies. The girls found the machines easy to operate. Everyone had fun with the twisting machine.

The teacher said what pleased her and made the project so worthwhile was the way the pupils learned to work and share with each other, for they had to take turns in operating the machines. There were not enough pliers for everyone to have a pair, so again the members of the class had to share. There was no fussing; each one was eager to help his neighbor when he could. The teacher said she was fascinated, for she could actually see them grow in poise and confidence. Each time they made a new piece they wanted to show it to everyone. They were allowed to take their pieces from room to room, telling how they had made it. These expositions showed that they had increased their vocabularies. For the first time in their lives they were looked up to by other members in the school. They were happy to be in this class so they could make these pretty things. They grew in appreciation of color, design, and beauty.

Not one child in the group from the highest to the lowest found a process he or she could not handle. For the first time they had tasted success. The class visited the factory and the trade school. The trade school group visited the prevocational class. The special class visited, and the prevocational class demonstrated how the machines were operated. They taught the older children in the special class group how to operate the machines.

One of the owners of a plastic company visited the group. He said he did not know it was possible for children to do such beautifully finished work. "Each piece was worthy of a craftsman. No one in the factory, even after years of experience could do nicer work."

In industry a great deal of waste in both time and material is made because the workers have not learned the basic skills before they are expected to compete with the skilled workers on production work. The basic operations should be taught slowly and carefully; then when the skills become automatic the work will be as skillfully made on production as when made slowly. Often complete shipments of an order have been returned and have had to be done over just because the operator hadbeen rushed before he had been ready for the job. Training would take care of this, and would be of benefit to both the worker and the employer.

It took the special class nearly six months to learn all the processes. At the end of this time they could make all kinds of chains. They made one like the samples and many different types of chains. Even the girl with the fifty-five I.Q. found she could do this, and she also learned to string beads and shape some simple flowers; she was very much pleased with her work.

These children did all their shaping with their fingers, pliers, and the wooden dowels. The prevocational class lent them the hand swedging dies and, as has been mentioned, the older boys learned to handle the machines, too. This class did not have a sponge pad to press their heated flower parts to shape them, so they made a pad by taking a regular sponge, putting it into a cloth bag, then nailing it onto a wood block. They made a second pad by stuffing a cotton bag with cotton and nailing it to a block of wood. Both were a success. The drilling was done with the hand drill as suggested earlier in the study. The teacher did most of the designing of their sample pieces. They learned how to paint and to cement as well as the other mentioned assembling processes. These children were just as fascinated and proud of their work as the prevocational class. They showed that lovely jewelry could be made without expensive machinery; it could be made by hand with just a pair of clippers, pliers, and a few wooden dowels; these had been made from a broom handle, a handle

from a discarded dishmop, and a pencil that had been rounded. (This they did with a knife and some sandpaper.) They had a small electric heater with a piece of asbestos. These comprised the tools in their workshop.

They also made letter openers and ash trays from catalin, as suggested in Plastics in the School and Workshop by A.J. Lockrey.

EXHIBIT OF PLASTICS BY PUPIL GROUP

Jewelry Items Turned Out In School Training Project

An exhibit of plastic jewelry, made by special classes at Priest street school and at the Lincoln school, is on display at Green's drug store.

The articles in the exhibit, wide in variety and large in numbers, were made by the pupils as a result of a survey carried out by Miss Hilda Hopkinson, supervisor of art in the public schools, to determine their aptitudes toward plastics, a major industry in

The survey was undertaken by Miss Hopkinson in September and has shown that many pupils are capable of handling plastics machines in factories while others can perform the work manually.

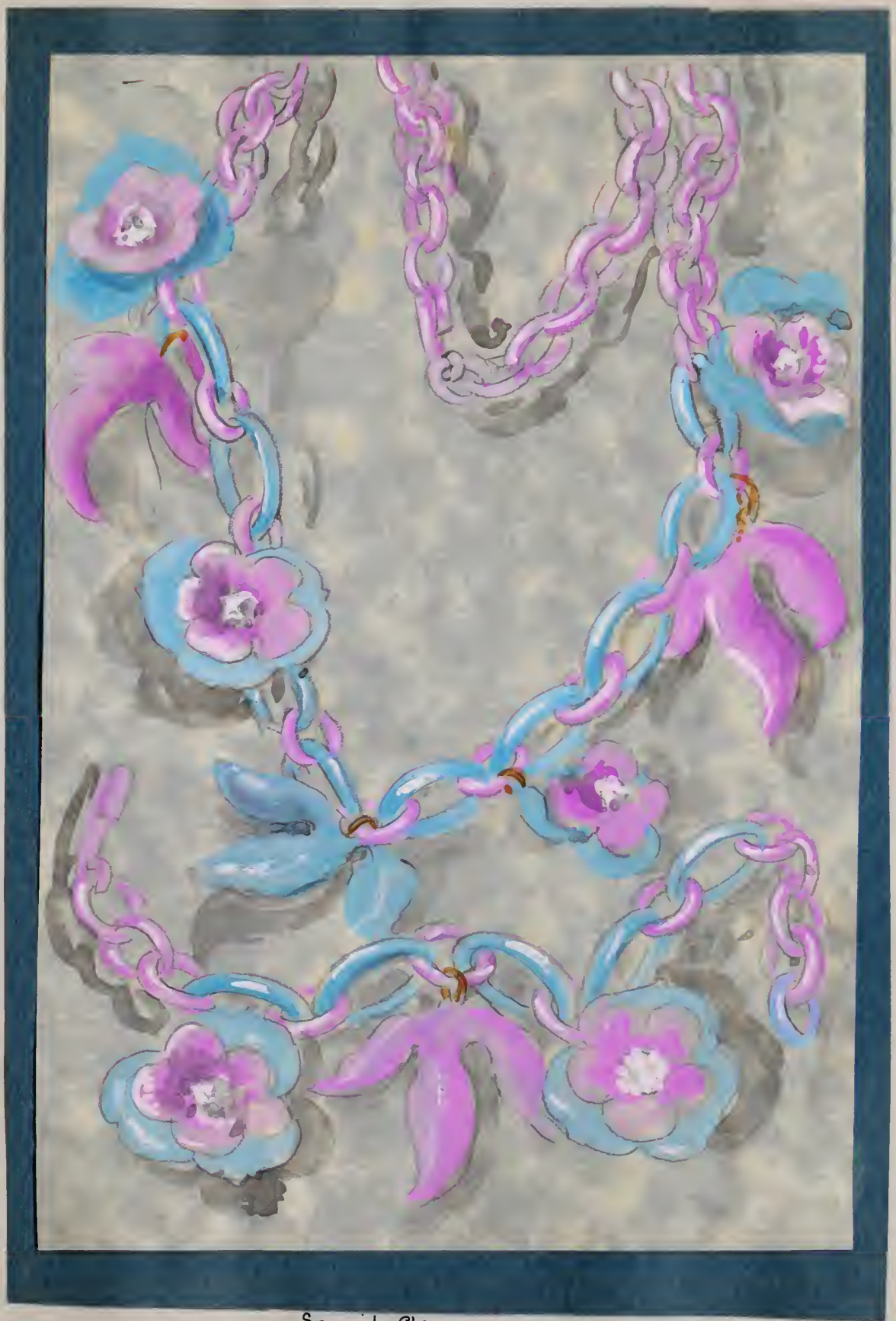
The articles made and shown in the exhibit have given the children a basic and fundamental training in the plastics industry.

Miss Hopkinson said that in carrying out the project, special emphasis had been placed on developing talent for design and application of color.

Provided with a thesis prepared by Miss Hopkinson, Mrs. Bessie Cheney, Priest street school principal, and Miss Nellie Barker, teacher at Lincoln school, carried out the project which produced the articles on display in the exhibit.

APRIL 7, 1944

Special Class



Special Class

Special Class

Special Class

THE TRADE SCHOOL GROUP

The group studied was made up of the plastic classes at the trade school. Here plastics have been taught to groups of boys for seven years. The classes are divided into first year, second year, and third year plastics. In the present three groups there are eighteen boys, each one fitting into one of the classifications of this study. There was no I.Q. record for seven in this group. These seven had transferred from schools in other communities. A survey was made of their scholastic standing over a period of six years. Their academic records were so poor that the author concluded that possibly these boys were also of low intelligence.

Table VII — The Trade School Group — I.Q. Rating

I.Q. Rating	No. in Group	First year	Second year	Third year
86-88	3	1	2	0
83-85	8	0	1	0
80-82		0	2	1
77-79		1	0	1
74		1	0	1
Transfer students no I.Q. record	7	2	1	4
Totals	18	5	6	7

The study of plastics was begun in 1936 as a result of

the Ford survey. At that time not many of the girls were working in the plastic factories. As Ford mentioned, most of the girls were working in garment factories and in domestic service; consequently, plastic work was not considered of enough value to girls to put it into their program. They were taught how to operate the machines used in the garment factories.

he instructor of the plastic classes has planned the work to fit the boys for work in the plastic factories. In their workshop there is every machine but a moulding machine. Here is a list of machines: four lathes, two ash wheels, two comb cutters, four jig sawa, two polishing wheels, one dise sander, two swedging machines, three sand wheels, three drill presses, four beveling machines, a bench lathe, two inlaying machines, two circular saws, one slash machine, twelve cementing presses.

The complete course covers three years. They have twenty shop hours a week. In this time they cover these jobs:

Ashing	Assembling	Bristling	Buckle Work	Buffing
Banding	Cementing	Dipping	Filing	Frazing
Labeling	Picking Patterns	Plugging	Polking	Punching
Riveting	Sorting	Stamping	Stringing	Striping
Tickling	Trimming	Tumbling Inserting	Turning	Spraying

During the first year the boys learn the names of the tools in the tool crib. The tools must be kept in order and the room kept clean. The pupils learn how to operate the drill press and learn center drilling, checking sizes of holes, drilling counter boring, counter sinking, and drilling with forms. The time allowed for learning is three to four weeks. The materials used while learning are wood, fiber, and non-inflammable material. When they learned they used plastic material applied to the actual job as done in industry.

In the first year they also have a unit called "Jig Sawing". They print patterns, make saw blades, learn how to file blades,and how to set blades into the machine. They learn how to saw a straight and curved line and how to select stock. After two or three months they are able to saw out samples. They practice with fiber, wood, and brass. This is a very valuable job in the factory and requires a great deal of skill.

The first year projects are all kinds of handles, letter openers, hat ornaments, wooden patterns and jigsaw puzzles.

The boys also learn how to operate the foot press and slashing machine this first year. They set up a job and learn form slashing. In this unit they make tee angles, name plates, safety goggles; they also carry out projects in using light gage materials. The time spent in learning is six to eight weeks. Non inflammable materials are used while learning.

They learn to operate the polking machine. The time needed to really operate this machine is three to four weeks. How to sharpen the cutters and how to take care of them is also taught.

The articles made are manicure handles, soap boxes, box covers, buttons, and all types of ornaments, also picture frames.

A unit in frazing is also begun the first year. They are taught to care for the cutters. Engraving and cut designs are frazed on plastic stock with these revolving cutters. The time needed to learn is three to four months. See page . This work requires some artistic ability if beauty of line and proportion are to be incorperated. Artistic ability will help the worker to do finer work and better modeling. Real frazing is not just following lines as many of the production workers in the factories do. The designer must always keep in mind that not all operators of the frazing machines are skilled craftsmen. Designs must be within their ability if the work is to be successfully done. The designer is thrilled to find skilled workers in this department.

Spraying is taught the first year. The time needed to learn is two to three weeks. Ashing and polishing are also taught. Learning time is six to eight weeks to do production work.

Second Year

All the previous training is reviewed and more difficult

projects are done the second year. The boys continue to saw and lay out patterns on bunched stock. (This means that several pieces of plastic stock are put together; a piece of paper is laid between each layer, then brads are used to keep the plastic pieces in place. The pattern is glued to the top piece; then the pieces are ready to be jigged.) Several patterns are cut at one time.

he pupils make shoehorns, clock frames, picture frames, powder boxes with covers, watch stands, and ash trays.

Straight slashing, cross slashing, and production work are begun.

Setting up of jobs, cutting their own designs, and chuck turning between centers are learned. Training period of four to six weeks is needed to handle the lathe.

Third Year

Now the class members experience sawing their original designs and patterns. They do sawing for inlay work. Outside sawing jobs are done, and the boys are paid for their work. They make letters of the alphabet to be used in signs.

This past year the boys made the war memorial in the square. They made all the name plates on the honor roll, a very well designed project of which they can all be proud.

The boys are taught responsibility the third year. They are given individual jobs to do for production work. They are taught shop standards and to take full charge of a unit of

work.

They learn to lay a complete pattern job on the stock with a minimum waste and with a number of pieces to the job. They learn the cost of each piece. Advanced projects are given in chuck turning and wood chucking.

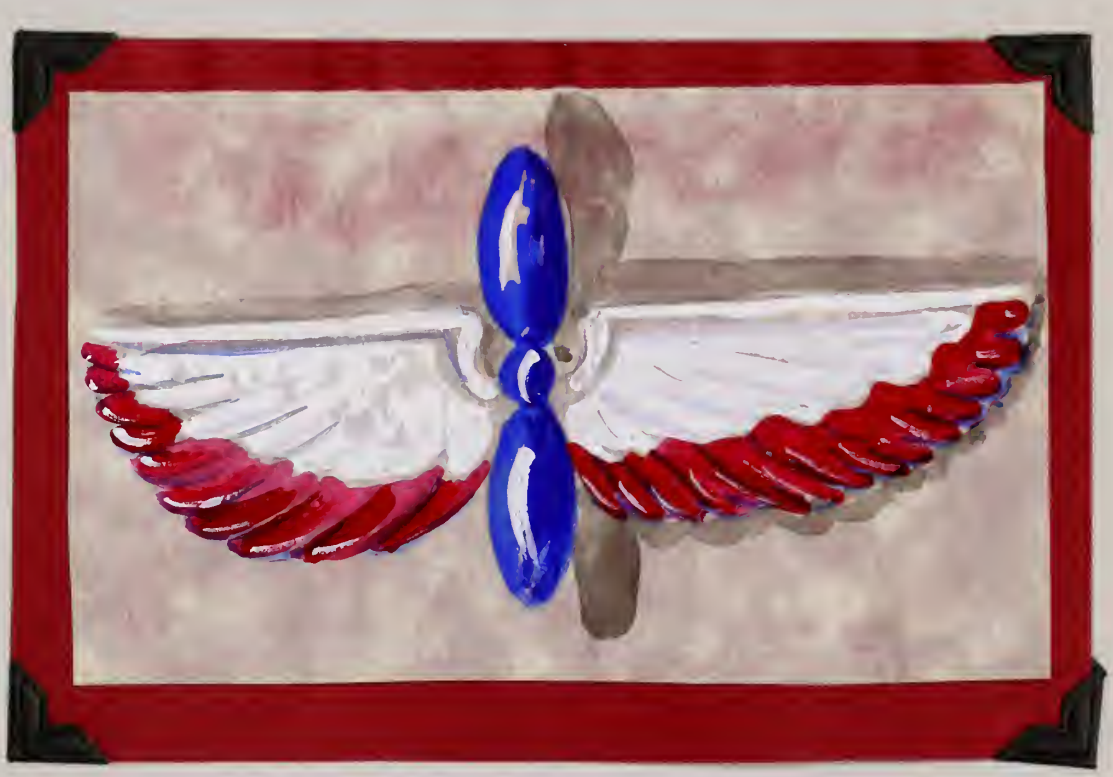
Projects such as hat ornaments, dress ornaments, buttons, toys, buckles, novelties, bracelets, etc., are carried out.

The class made some beautiful lamps, quite original in design. One was called the "Wishing Well", a replica of the old oaken bucket. A very beautiful magazine rack made from two flat pieces of opalescent greenish blue plastic set into an overturned wooden chopping bowl, held in place with plastic rods of the same material.

The candle sticks they made were worthy to be museum pieces, they were so carefully made and artistically designed. Lovely candy bowls, ash trays, coasters, and personal ornaments were made; also hot dish plate stands, model airplaines, gavels, and mallets. A very fine plastic gavel was made for the head of the vocational schools in the state and one for the local superintendent of public schools.

The complete plastic course, carried over the three years, teaches drilling, spraying, dipping, hand painting, assembling, cementing, polking, swedging, pressing, turning, ashing and polishing, tumbling, bending, beveling, sawing, frazing, and designing.

Original designed pin by one of the third year boys. He is sixteen with an I.Q. of 78. He had an opportunity to work but his father wanted him to stay in school a while longer.



CHAPTER IV

SUMMARY AND CONCLUSION

The purpose of this study was to ascertain the value of vocational training in the plastic field for the mentally retarded and to determine whether such training can be successfully taught in a prevocational class.

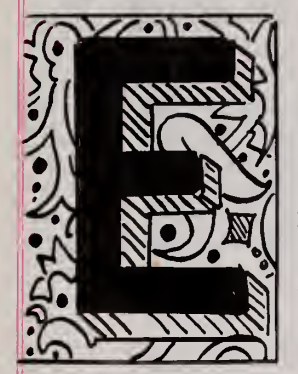
Summary of Procedures

A survey was made of all the former prevocational pupils who had left school in the six years between September, 1937, and September, 1943. There were one hundred seventy-five children, one hundred four boys and seventy-one girls. All were located but four who had moved from the community. One hundred forty-six were in industry. Only ten boys and nine girls were not working; these had home permits. Two boys were doing farm and dairy work. One girl was in domestic work. Two boys and one girl were in institutions for the delinquent.

Of the one hundred forty-six located in industry one hundred thirty-six were in the plastic factories. One girl was working in a slipper factory; five girls were stitching in a garment factory. Two boys were working in a furniture company, doing upholstery work. Two boys were found working in a leather factory.

Fifty-one boys, working in the plastic industry, were

found to have had some plastic training during their formal education at the trade school. Only two of these boys changed their jobs.



ach of these boys changed but once, making two changes for the fifty-one boys.

Thirty-three boys in the plastic industry had not had any training in plastic work. It was ascertained that this group had changed their jobs one hundred and thirty-four times, an average of four times each.

The fifty-two girls who were stitching in the garment factory had been trained in this work during their formal training at the trade school. These girls had not made any changes since they had begun their work. One girl had been working four years; the others had worked two to three years in the same place.

Table VIII Changes Made by the Boys and Girls in the Plastic Industry

	Boys Trained	Boys Untrained	Girls Untrained
Working	51	33	52
Changes	2	134	166

It was found that a large number of the boys (forty of them) was operating the press machines, which included polking or blanking and swedging. Eight girls in the group were

found in this department. The I.Q.'s of the boys and girls ranged from seventy to ninety-four.

Twenty-two of the girls were found in the painting, spraying, and dipping departments. The I.Q.'s for this group ranged from sixty to ninety-five. The two lowest I.Q's were found in the spraying department. The next to these, sixty-seven, was found in the painting department. This young lady had become so skilled in painting she now holds the position of forelady in the painting department.

Fourteen boys were working in the ashing and polishing department; just one girl was polishing. The I.Q.'s of this group ranged from sixty-one to eighty-two.

Twelve girls were working in the assembling department. The lowest I.Q. in this group was seventy-two; the highest, ninety-six.

Ten boys were operating the jigsaws and frazing machines. Not one girl was found in this department. The I.Q.'s ranged from seventy to ninety-five in this group.

Five girls were operating the degating machines. The lowest I.Q. here was eighty; the highest, eighty-eight.

Two boys and two girls were working in the hot water department. The I.Q.'s in this group ranged from seventy-one to seventy-six. The floor boy, with an I.Q. of fifty-nine, was working in this department. It was his job to carry the finished work away and bring new stock to the workers. He

did not have anything to do with the making of the parts.

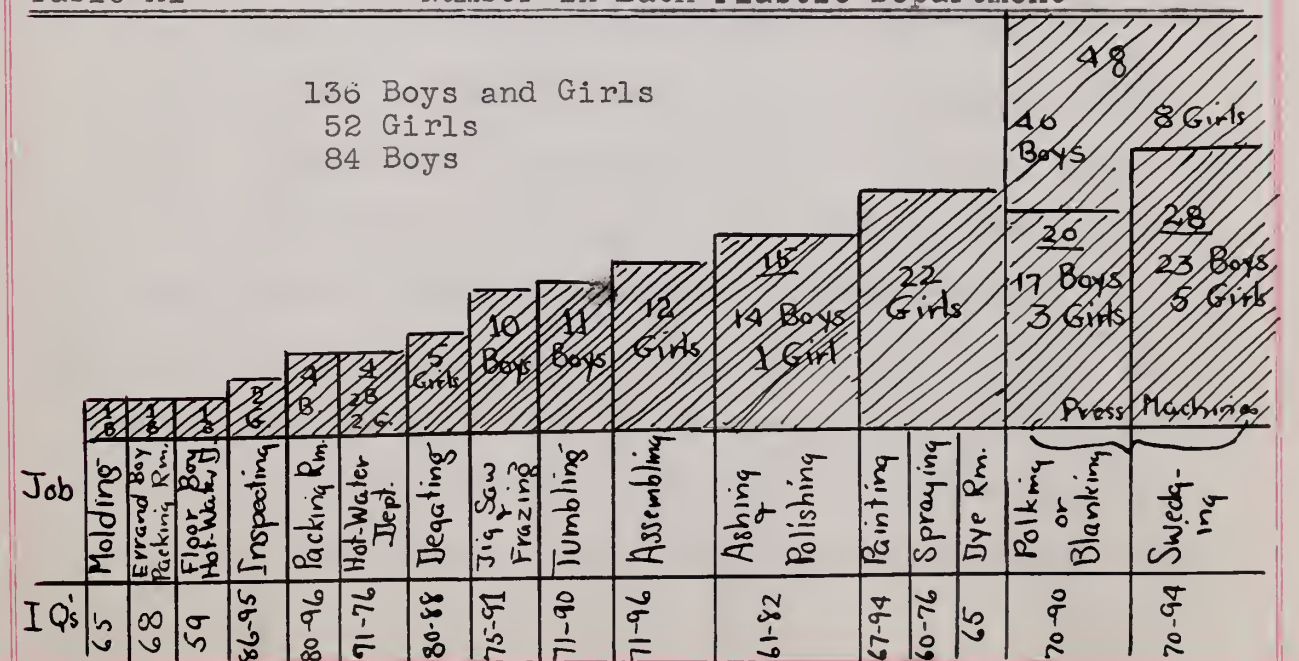
Four boys with I.Q.'s ranging from eighty to ninety were working in the packing room.

Two girls with I.Q's of eighty-six and ninety-five were in the inspecting department.

Only one boy was found working in the molding department. His I.Q. was sixty-five. As has been mentioned previously, even though these machines are the easiest to operate in the plastic industry, it is better that these mentally retarded individuals do not operate the molding machines. These machines cannot be relied upon not to skip. If the operator has not mental alertness to withdraw his hand before the machine closes, he is likely to lose his hand.

The boy with the sixty-eight I.Q. was found doing odd jobs in the packing room. He was called an errand boy.

Table XI Number in Each Plastic Department



The experiment carried out with the prevocational class ascertained that vocational training could be successfully taught in their classroom. The work, as it was planned, could be handled by each child in the class. The results showed that the teacher did not have to have previous plastic training to teach the class successfully. The work was found to be beneficial not only in training manual dexterity but also in training worthwhile traits of character. It developed poise, gave the pupils a feeling of self-confidence and a better undertanding of how to work and share with others as they will have to do when they leave school to earn their living. The operating of the machines built a foundation for them on which to build a future trade. When they enter the factory they will feel at ease. It was found to be a practical and worthwhile project.

The experiment as carried out in the special class showed that the plastic work could be taught as a hand project. The children learned the basic fundamentals of making plastic jewelry. It gave them training in finger dexterity which they can use in any type of handwork. It brought out all their creative talents, trained them in the appreciation of color, design, and in beauty. The real merit in the findings in this class was that plastic work can be a valuable handwork project and it can be taught without machinery and by the regular classroom teacher who does not need any preliminary training in plastic work.

The study of the groups doing plastic work at the trade school ascertained that vocational plastic training can be given to the mentally retarded, that these children can be taught to handle machinery under factory conditions, and that they can be trained to become skilled in operating the machinery used in the plastic industry.

At the trade school they receive a thorough training in the three years of plastic work, but the three years are not absolutely necessary to fit them to earn a living. Many leave after one year of training because they are of age to work. These boys find places to work. The instructor said that he could not train the boys fast enough to supply the demand of employers for their services.

Conclusion

From the findings of this study the author concludes that:

Training is valuable and necessary for the subnormal individual. Table five shows that those who have been trained find work and remain at one job. Those without training change their work many times; in fact, one boy in this group actually changed his work ten times and made six of these changes within on year.

The survey shows that there is a definite place in the plastic industry for the subnormal individual. Such persons can handle every job but one, the setting up of the extruding machine; this requires intelligence and skill. The survey

shows that not many of them work in the molding department, and that it is better so. The author feels they should not be allowed to operate these machines until the machines have been perfected to be absolutely safe.

he author concludes that evidently the lowest I.Q. that can operate the press machines is seventy. The lowest that can operate the jigsaws and the frazing machines is also seventy. The lower I.Q.'s were found doing handwork that did not require the handling of machinery. The degating machines evidently require at least an eighty I.Q. The inspecting work seems to require a higher I.Q., for the lowest found in this group had an I.Q. of eighty-six. These girls must also have good vision.

The survey made of all the factories showed that the majority of the working women were in the plastic industry. This being so, the author feels there is a need for a training course in plastics at the trade school for the girls as well as for the boys. When the Ford study was made, there were only seven plastic factories; now there are sixteen in this community, which presents just a sample of the growth of the plastic industry throughout the country. The author feels that eventually plastics will be the leading industry in the United States.

Made by the Prevocational Group.

Taken Dec. 1943

Jewelry made by the Special Class Group. Taken Mar. 1945

From the classroom experiment the author concludes that vocational plastic training can be taught successfully by the prevocational teacher in the classroom. The children can be taught to handle swedging and polking machines, the automatic drill, and the twisting machine that is used in the hot water department. They can be taught assembling of all types of chains, stringing of beads, the assembling of the hanging parts on the strings, cementing, hand painting, all types of shaping of plastic parts by hand with hand tools and hand dies, as well as swedging with the hand machine.

The author feels that such a class curriculum would be of value to any prevocational class for it would teach manual dexterity, which is of value to any type of industrial or hand labor. The handling of the machinery would accustom the pupils to work in any industrial plant. The training would be of value to the individual for it would bring out all his creative ability, help him to grow in the appreciation of design, color, and beauty. It would build the confidence in him that comes only with the experience of success. The results of such a project are so lovely and professional looking that the satisfaction gained by the one who has made the piece is worth a great deal. This feeling is not an every-day occurrence for the subnormal; in fact, it is rare. This satisfaction builds confidence, and the opinion of the author is that these individuals should be given as many opportuni-

ties as possible to grow in confidence.

Because some of the children in the prevocational classes do not go to a trade school (many go to the junior high school and many just remain in this classroom until they are of age to work), the author concludes that vocational training in a prevocational classroom would be of value,for it would give every child in the prevocational class some basic training in plastic work while he was in this classroom. This would give him a practical foundation that he could apply when he left school to earn a living. The training would not interfere with further training that he would get if he went to the trade school; there he would meet the same conditions as would the child entering industry, for both use the factory machines. The child would find it easy,because of the previous classroom training, to make the transition from the hand machines to the automatic machines, and could more easily adjust himself to the conditions. Those who left the classroom to go to junior high would have had some training so that when they left school to work in the factory they would not find the work so hard to adjust themselves to as they would have if they had had no previous training in plastic work.

With a basic training in plastic work they could enter industry with a higher rate per hour in wages. Being trained, they would be skilled enough to earn more each hour and would thus earn higher wages. If trained in the basic skills, they

could enter industry with confidence, knowing which job they could handle best and which one they would be happier in doing.

f they did not go into the plastic industry but went into some other industry,the skill they had acquired in finger dexterity would enable them to better handle and learn the required process in the new industry.

As so many others have said they had found in their studies, these children do enter industry. The author concludes that these children should be given practical vocational training while they are in school.

CHAPTER V

SUGGESTED STUDIES AND FURTHER INVESTIGATIONS

he author felt when she was collecting data for this investigation that there was a need for research study to be done in the plastic field and then written in the language of the layman.

A few suggested studies and further investigations in this field in education are:

A Place for the Physically Handicapped in the Plastic Industry

Opportunities for the Blind in the Plastic Field

Plastics in Hospital Rehabilitation Work for the Army

Opportunities in the Plastic Industry for the Boy and Girl of Today

Hand Projects in Plastic Work for the Elementary Classes

The Value of Plastics for the Medical Student

Opportunities for the Crafstman in the Field of Plastics

Art Appreciation Taught Through the Medium of Plastics

A Research Study to Show the Growth of Art in Design and Craftsmanship in the Plastic Field

The plastic industry is growing by leaps and bounds. It is a new field and is so wide that it offers many, many opportunities for study. The list gives you but a few suggested plastic studies that might be done in the field of education.

BIBLIOGRAPHY

BOOKS AND MONOGRAPHS

Mentally Handicapped

Arch, Oliver Heck. Education of Exceptional Children,pp. 341-359. New York: McCraw-Hill, 1940.

Averill, Laurence Augustus. The Teacher as a Mental Hygienist, pp. 81-106. New York: Pitman Publishing Company, 1939.

Bennett, Annette. Comparative Study of Subnormal Children in the Elementary Grades. Teachers College Contributions to Education, No. 510. New York: Teachers College, Columbia Univeristy, 1932. pp. iii+ 81.

Burt, Cyril L. The Backward Child, pp. 564-626. New York: Appleton-Century Company, Inc. 1937.

Dickson, Virgil E., Mental Tests and the Classroom Teacher, pp. 34-42, New York: World Book Company, 1923.

Dunlop, Florence S. Subsequent Careers of Nonacademic Boys. Columbia University, Ottawa, Canada: National Printers Limited, 1935. pp. 93.

Goddard, Henry H. School Training of Defective Children, pp ix-xx, 9-15. New York: World Book Company, 1923.

Hollingworth, Leta S. The Psychology of Subnormal Children, New York: The Macmillian, 1921. pp. xix+ 288.

Ingram, Christine P. Education of the Slow Learning Child, pp. 389-418. New York: World Book Company, 1935.

Inskeep, Annie Dolman. Teaching Dull and Retarded Children, pp. 333-383. New York: Macmillian Company, 1930.

Oliver, John Rathbone, Psychiatry and Mental Health, pp. 124-126, New York: Charles Scribner's Sons, 1932.

Pinter, Rudolf. Intelligence Testing, pp. 38, 80-86. New York: Henry Holt and Company, 1931.

Pitchard, Miram C. The Mechanical Ability of Subnormal Boys. Teachers College Contributions to Education, No. 699. New York: Teachers College, Columbia University, 1937. pp. 73.

Terman, Lewis W. The Intelligence of School Children, Baston: Houghton Mifflin Company, 1919, pp. vii+ 317.

Terman, Lewis W., The Measurement of Intelligence, p. 78, Boston: Houghton Mifflin Company, 1916.

Toops, Herbert A. Tests for Vocational Guidance of Children Thirteen to Sixteen, pp. 45-46. Teachers College Contributions to Education, No. 136. New York: Teachers College, Columbia University, 1923.

Unger, Edna W., and Burr, Emily T. Minimum Mental Age Levels of Accomplishment. Albany, New York: The University of the State of New York, 1931. p. 108.

Warren K. Baller. Present Social Status of a Group of Adults, pp. 171-209. Genetic Psychology Monographs, Vol. 18., No. 3., 1936.

White House Conference on Child Health and Protection. Special Education, the Handicapped and the Gifted Child, pp. 439-488. New York: The Century Company, 1931.

Books on Plastics

DuBois, J.H. Plastics, pp. 1-21, 63-84, 225-241. Chicago: American Technical Society, Publishers, 1943.

Lougee, E.F. Your Place in Life, "Your Career in Plastics," pp.3-14. Illinois: McDonnell and Company, 1938. Revised, 1942

Monsanto Plastics, 1 B/7. Springfield, Massachusetts: Plastic Division, Monsanto Chemical Company, 1943. pp. 23.

Plastes. Plastics in Industry, Brooklyn, New York: Chemical Publishing Company, Inc., 1941. pp. 241.

Plastic Catalogue, pp. 110-112, 130, 132. Plastic Catalogue Corporation, 1943.

Simonds, Herbert R. Industrial Plastics, second edition. New York: Pitman Publishing Company, 1941. p.385.

Stockley, James. Science Remakes Our World, Chapter IV, New York: Ives Washburn, Inc., 1942.

Bulletins and Unpublished Work

Mentally Handicapped

Channing, Alice. Employment of Mentally Deficient Boys and Girls. United States Department of Labor, Children's Bureau

Publication No. 210. Washington, D.C.: United States Government Printing Office, 1933. p. 69.

Kellogg, Roberta Mead. "A Follow Up Study of One Hundred Males Who Spent Some Time in the Special Classes in the Public Schools of Newton." Unpublished Master's thesis, Boston Univeristy, 1941. pp. iii+ 95.

Louttit, C.M. The Mentally Deficient in the National Emergency. pp. 157-162. The Training School Bulletin, xxvi. Vineland, New Jersey: Vineland Training School Publishers, January, 1941.

Manual for Special Classes. Massachusetts Department of Education Bulletin, No. 2, Whole No. Boston, Massachusetts Educational Department, October 25, 1934, p. 41.

Martins, Elsie H. Occupatioanl Experience for the Handicapped Adolescents in Day Schools. Bulletin No. 30. Washington: Government Printing Office, 1938.pp,31.

Vocational Guidance and Junior Placement. pp. 42, 44. United States Department, Children's Bureau, No. 149, Washington: Government Printing Office, 1925.

Plastics

Ford, Edwin T. "Report on the Guidance Project at Leominster", p.p.12. (October 14, 1935), Massachusetts: Educational Department.

Marshall, Stanley L. "The Replacement of Men by Women in the Plastic Industry." pp. 7-12. Unpublished Master's thesis, Wharton School, University of Pennsylvania, 1943.

Periodicals

Mentally Handicapped

Abel, Theodora, M. "The Subnormal Girls with Discrepant Test Patterns." American Journal of Mental Deficiency, (July, 1940), pp. 45-72.

Baily, Pearce. "Mental Deficiency; Its Frequency and Characteristics in the United States as Determined by the Examination of Recruits." Mental Hygiene, IV (July, 1920), pp. 564-596.

Bond, Elden A. " Method of Selecting Subnormal Children for a Vocational School." Journal of Juvenile Research, XXI (July, 1937), pp. 188-192.

Broome, Edwin C. "Industrial Arts and the Problem of the Maladjusted Pupil." Industrial Education Magazine, XXVII (January, 1935), pp. 15-17.

Frandsen, Arden N. "Mechanical Ability of Morons." Journal of Applied Psychology, XXI (August, 1935), pp. 371-378.

Hirsch, N.D.M. "Relationship between Interest Ability and Self Estimated Ability among Maladjusted Boys." Journal of Abnormal and Social Psychology, XXIV (July, 1939), pp. 359-399.

Hoopes, Paul C. "What to Do with the Dull Child." Industrial Arts and Vocational Education, XXV (January, 1936), pp. 8-9.

Hungerford, Richard H. "The Detroit Plan for the Occupational Education of the Mentally Retarded." American Journal of Mental Deficiency, XVII (May, 1938), pp. 409-416.

Keys, Noel, and Nathan, J.M. "Occupations for the Mentally Handicapped." Journal of Applied Psychology, XVI (October, 1932), pp. 497-511.

Kunitz. "Therapy for the Maladjusted." Journal of Health, Physical Education, (March, 1937). pp. 143-145, 197-198.

Lord, Arthur B. "A Survey of Four Hundred Forty-nine Special Class Pupils." Journal of Educational Research, (October, 1933), pp. 108-114.

Lynch, Katherine D, "Enrichment of the Program for Subnormal Children." Journal of Exceptional Children, V (December, 1938), pp. 49-53.

McIntire, Gloria. "Let Pictures Tell the Story: Retarded Pupils Get Simplified Job Information." Occupations, XX (November, 1941),

Mueller, John A. "Adjusting the Below Average Pupil." Occupations, XVIII (October, 1939), pp. 98-100.

Neterer, Inez. "Follow-up Study of Special Class Pupils." Ungraded, Vol. V, No. 5, No. 6-7 (February, 1920; March-April, 1920), pp. 116-118, 150-154.

Plant, James S. "The Importance of New Developments in Machine Operations." XVIII (January, 1937), pp. 879-887.

PLASTICS

Breskin, Charles A. "Plastics in the Future." Vogue, (February,

1943), pp. 53, 123.

"Plastics." Building America, VIII, No. 7 (April, 1943), pp. 194-223.

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